THE

Tool Engineer

JANUARY 1957

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Heald **RED HEAD'S** extra precision and low maintenance

NOW AVAILABLE TO ALL USERS

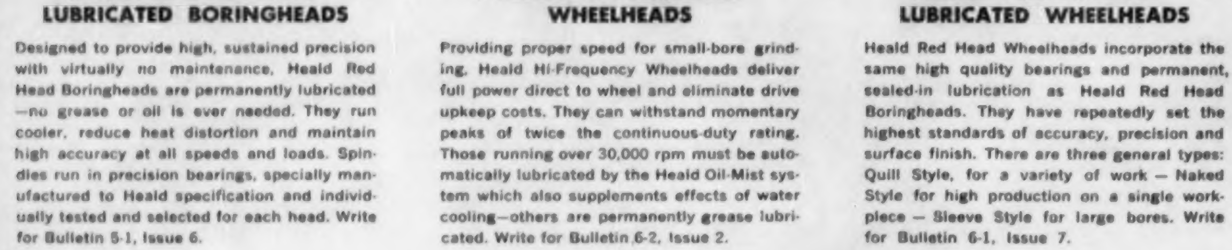
of boring and internal grinding equipment

Heald Red Head Boringheads and Wheelheads have achieved an enviable reputation for extreme precision and exceptionally low maintenance, on Heald Bore-Matics and Internal Grinders in use throughout the entire metalworking industry. Heretofore, they have been available only as original equipment or replacement items for specific Heald machines.

Now, however, in response to a continual and ever-increasing demand — and in line with the Heald policy of building standard machines and parts — it has been decided to market all standard Red Head Boringheads and Wheelheads without restriction wherever practical. This means that the extra precision and low maintenance provided by Heald Red Heads are now available to all users or manufacturers of metalworking equipment, regardless, in most cases, of the type of machines on which they will be used.

The standard head types and sizes that can be supplied are fully described and listed in the Bulletins noted below.

·RED HEAD·
HEALD



HEALD PERMANENTLY-LUBRICATED BORINGHEADS

Designed to provide high, sustained precision with virtually no maintenance, Heald Red Head Boringheads are permanently lubricated —no grease or oil is ever needed. They run cooler, reduce heat distortion and maintain high accuracy at all speeds and loads. Spindles run in precision bearings, specially manufactured to Heald specification and individually tested and selected for each head. Write for Bulletin 5-1, Issue 6.

HEALD HI-FREQUENCY WHEELHEADS

Providing proper speed for small-bore grinding, Heald Hi-Frequency Wheelheads deliver full power direct to wheel and eliminate drive upkeep costs. They can withstand momentary peaks of twice the continuous-duty rating. Those running over 30,000 rpm must be automatically lubricated by the Heald Oil-Mist system which also supplements effects of water cooling—others are permanently grease lubricated. Write for Bulletin 6-2, Issue 2.

HEALD PERMANENTLY-LUBRICATED WHEELHEADS

Heald Red Head Wheelheads incorporate the same high quality bearings and permanent, sealed-in lubrication as Heald Red Head Boringheads. They have repeatedly set the highest standards of accuracy, precision and surface finish. There are three general types: Quill Style, for a variety of work — Naked Style for high production on a single workpiece — Sleeve Style for large bores. Write for Bulletin 6-1, Issue 7.

IT PAYS TO COME TO HEALD

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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N SOCIETY OF TOOL ENGINEERS

COVER: When production volumes are high, it may be more economical to manufacture small stampings on a four-slide press than on a progressive die. An article on page 81 lists pertinent factors to be considered before making a choice between the two methods.

The Tool Engineer

Volume XXXVIII, No. 1 January 1957

TECHNICAL ARTICLES

ASTE NEWS

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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The Tool Engineer

Sharing is Growing

Much technical information is lost in a company, in an industry and in a nation when lack of proper evaluation, communication or both prevent a known fact from being applied to its fullest extent. No single factor or group in business or industry can stand alone.

If a tool engineer uses a technique or method that has never been used before, he satisfies his function and he advances his art—for one job. That application may remain unique, however, unless he passes the word along. If he takes it upon himself to inform his fellow tool and design engineers, chances are that other applications will be found. The idea will no longer be unique but it will have gained immeasurably in value.

Advancement cannot be restricted to individuals, to companies or even to isolated nations. Over a period of time, standards of living, which are easy to compare, will seek a common level. The levelling process can be upward toward the most advanced or downward toward the least advanced. Communications, in a large measure, determine the levelling direction.

As an individual draws from the fund of common knowledge, so should he add to it. Experience is said to be the best teacher but much time can be saved by studying the experiences of others. It is easy to see that positive results will add to an individual's knowledge; it is not so easy to see that negative results also add to the store of knowledge. There is always valuable data in the scrap pile. All useful information should be shared.

Companies with active programs of research and development in design or production activities should take inventory of the knowledge that has been accumulated. Results of tests and production methods should be correlated. Perhaps new ideas and applications will become apparent. Efforts of these activities should be made known and available within the company, and serious consideration should be given to the ways in which this information can be more widely shared.

Robert A. Wason
ASSOCIATE EDITOR

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-5

Simplified Automation in
Successfully Applied in New

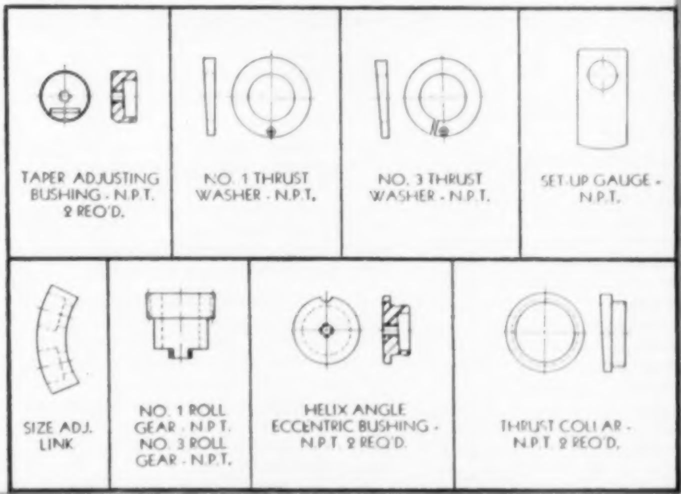
is greatly improved to permit rolling directly to a shoulder with safety.

Of an adjustable design, the LANROLL Attachments provide wide range coverage while retaining the rigidity of a non-adjustable tool. Either straight or tapered threads can now be produced with the same attachment through the use of proper rolls and auxiliary equipment. Five sizes with varying dimensions are available for use on the many sizes and makes of bar automatics, and will produce coarse pitch threads to Class 4 tolerances on all diameters from #5 to 1¾" for straight threads, and precision pipe threads from $\frac{1}{16}$" to 1¼" in diameter.

In addition to proper rolls, the auxiliary equipment necessary to change from straight to taper threading is negligible, as illustrated in Figure 2. When changing from one pipe size to another within the range of the attachment, the size adjusting link, set-up gage and rolls are the only equipment changes required. With this design tooling flexibility is obtained with minimum cost. These changes assure operation of the attachment for every size within its range as though it were exclusively engineered for the particular work being threaded. Also, the same simplified and precise methods of set-up and roll timing used for straight threading are used for taper threading.

For additional information ask for Bulletin G-96 and specify straight or taper work.

Figure 2



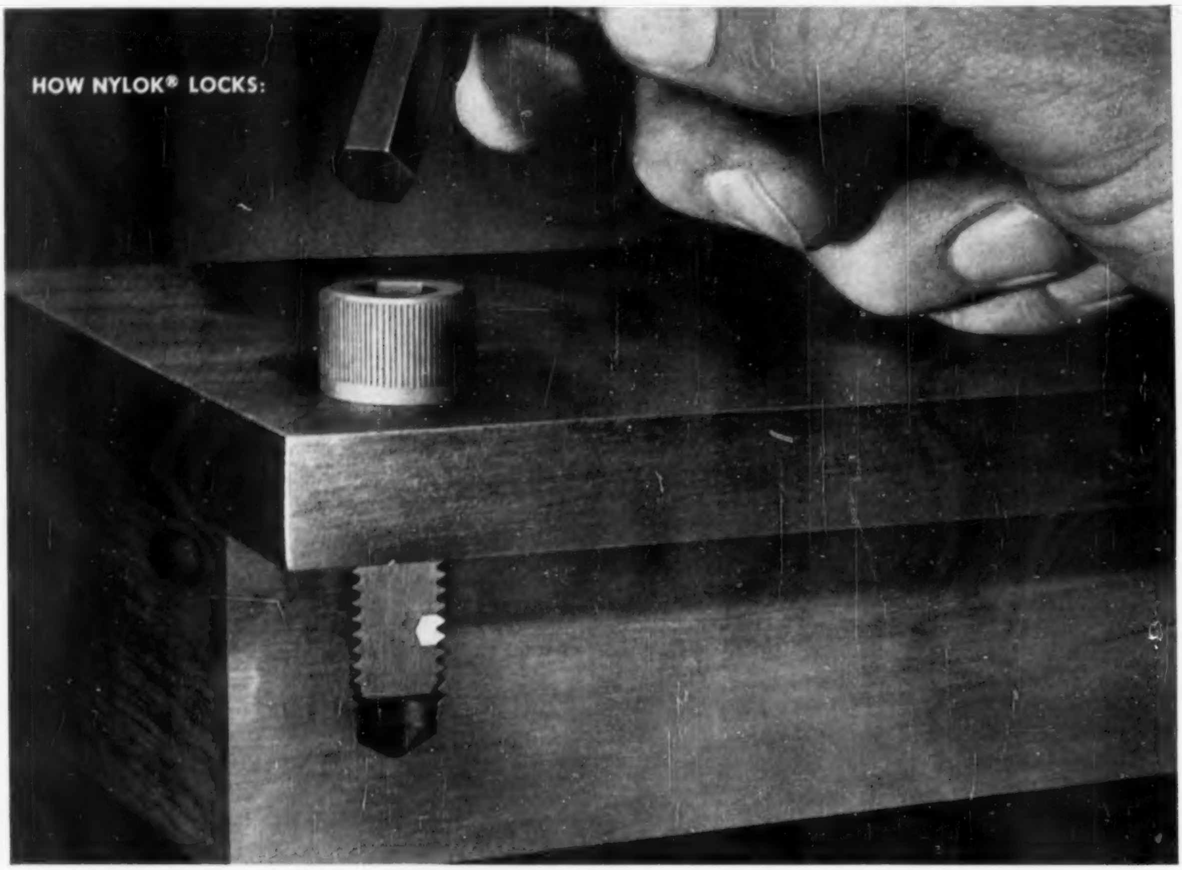
longer roll life with LANDIS parallel-roll method

Note that in producing a taper thread one end of each roll is required to thread a larger diameter than its opposite end. This results in unequal circumferential travel by the respective roll ends during each revolution. However, in traveling these unequal distances both ends of the roll make a revolution in the same interval of time. Therefore, the end of each roll on a large thread diameter must travel at a higher peripheral velocity than its opposite end on the small diameter. These necessary differentials in peripheral velocities for the roll ends can only exist by slippage between the roll and the workpiece. This slippage becomes more acute on the larger diameters as the differentials become greater or where tapered rolls on parallel axis are used. **By presenting parallel rolls to the workpiece, the LANDIS Method (see Figure 1) reduces the differentials in peripheral velocities and its accompanying roll slippage.** Roll life, of course, is greatly benefited by any reduction of slippage.

In developing a roll diameter for a particular thread, the pitch diameter of the workpiece is used as a basis. If the workpiece is straight, the relationship of the roll diameter to the workpiece diameter remains constant. For taper threads the roll diameter is normally developed from the pitch diameter at the mid-point of the effective thread. Thus, the diameter of the roll thread in respect to the diameter of the workpiece thread will only agree at one point. On either side of this point the roll diameter will be either too large or too small. This disagreement in the roll and workpiece diameter relationship results in attachment instability (sidewise movement). Maximum instability occurs if taper threads are produced with tapered rolls on parallel axis as the relationship of the roll and workpiece diameters vary in direct opposition. This instability becomes more apparent on the larger diameters as wider thread rolls having a greater disagreement are required to produce the longer thread lengths. **By use of parallel rolls on inclined axis (see Figure 1) the LANDIS Method reduces disagreement in the relationship of the roll and and workpiece diameter by one half.** In this case, both ends of each roll have a pitch diameter equal to the P.D. from which the roll was developed. Improved attachment stabilization results and rolling to a shoulder can be accomplished with safety.

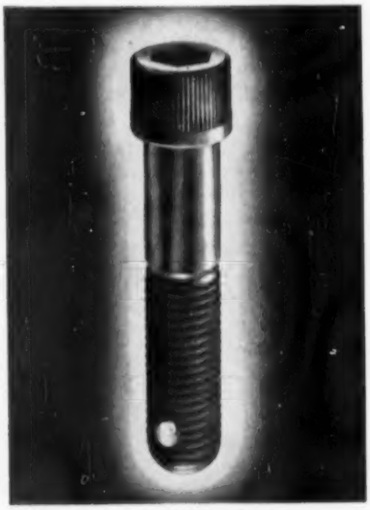
LANDIS *Machine* COMPANY WAYNESBORO PENNSYLVANIA

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-9



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

NEW—self-locking UNBRAKO socket head cap screws



Self-locking UNBRAKO socket head cap screw.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

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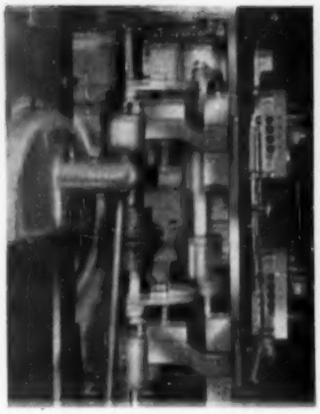
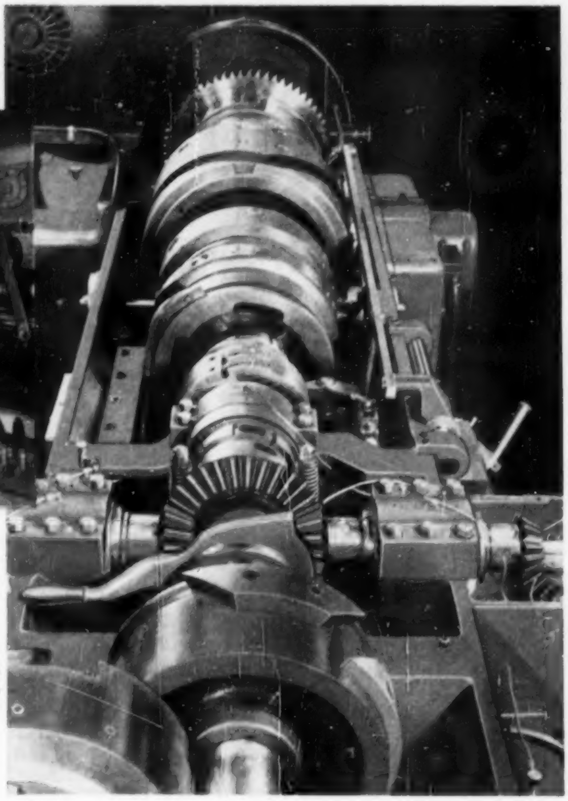


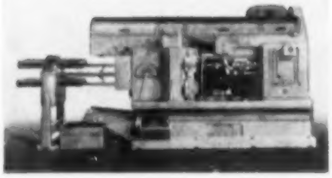


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes.
Write, wire, or phone for literature.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

GISHOLT

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HARNISCHFEGER CUTS CHANGE-OVER TIME ON BEVEL GEAR BLANKS

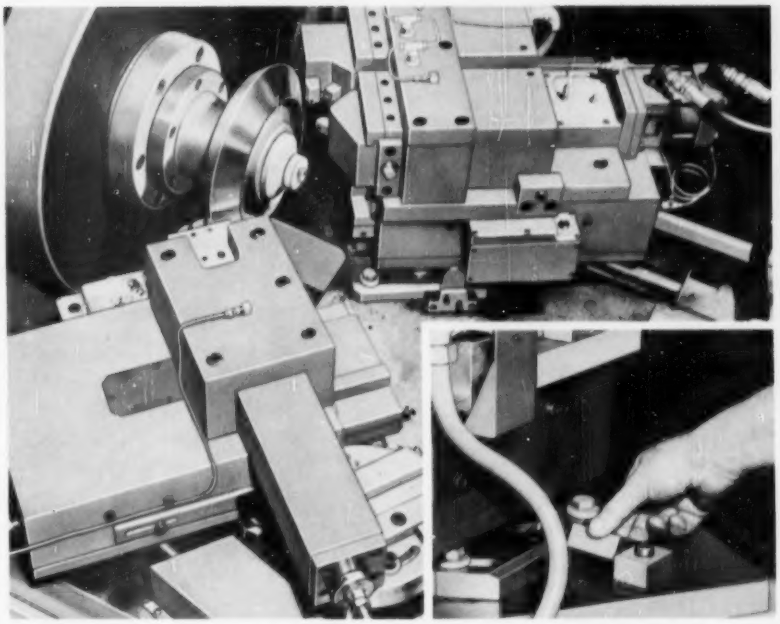
Master gauge blocks speed angular setting of tool slide

You may get ideas from the way Harnischfeger Corp. whipped a problem in bevel gear blank machining at its Escanaba, Mich., plant through installation of a Simplimatic Automatic Lathe.

Only one machine is used to handle three different types of the gear blank workpieces. Two types of workpieces are driven through the bore, from a previously machined spline or keyway. The third type, with a smooth bore, is driven from a lug on the back part of the workpiece. Eleven different workpiece sizes are produced, with yearly production ranging from 60 to 1800 pieces. Individual lots range from 20 to 200 pieces.

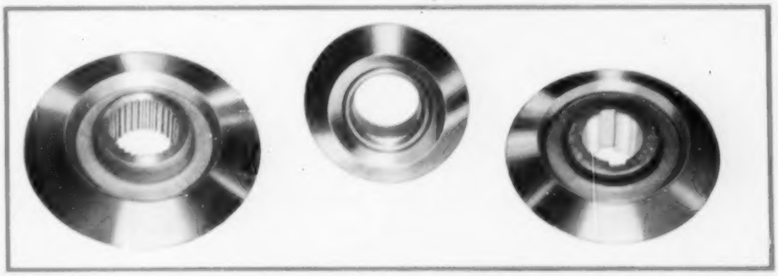
Here's the tooling picture—smartly planned to speed setup and change-over: A swivel-base slide—mounted on the rear of a special wide platen table—is tooled to simultaneously machine the back angle, the front counterbore and face, and break the sharp corners on the workpieces. At the end of the cut, the straddle-type tool blocks swing open for tool relief. Change-over is streamlined by special master gauge blocks with the correct angle machined on one face.

A special tool block with a sliding tool holder is mounted on the front slide. Tool movement is controlled, using a special cam and pedestal arrangement. Front slide movement is translated into correct angular motion by this sliding tool holder, which is controlled by the position the operator sets the cam on the pedestal. An angular dial plate speeds correct setting for the rough and finish front-angle facing operation.



▲ Overhead view of front and rear tool slides. Placing master gauge block between positive locating stop on platen table and swivel base of slide (inset) permits fast, accurate setting of tool slide at precise angle.

The center gear blank (bevel pinion for jackshaft) has smooth bore, is 4 7/8" wide with 9 5/16" O.D.; lower left (crawler bevel gear) has splined bore; lower right (bevel gear) has keyway in bore. All 3 types handled with this setup. ▼



Simple gauge blocks, swivel-base slide, adjustable slide tops speed change-overs.

F.t.f. time, 2 min. for smallest and 2.30 min. for largest parts handled.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

SIMPLIFY YOUR SETUPS WITH

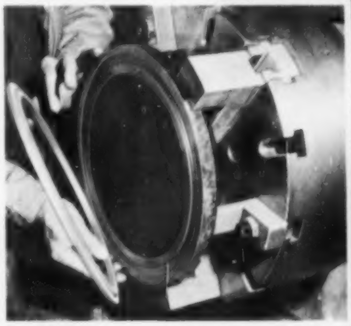
IOWA VALVE CO. STEPS UP OUTPUT WITH SMART TOOLING

Replaces three machines with 2L on variety of valve parts

Perhaps you, too, can take advantage of this setup used by Iowa Valve Co., Oskaloosa, Iowa—demonstrating how a standard saddle type turret lathe can be specially tooled to handle a variety of part sizes, combining standard and special machining operations.

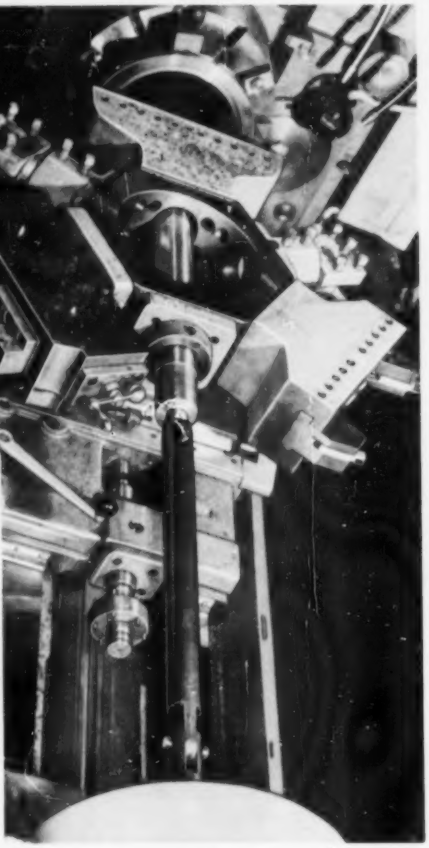
Here's how the workpieces—4", 6", 8", 10" and 12" diameter low-pressure valve gate seats—are machined with minimum change-over time between sizes: All work is from a cross-feeding hexagon turret. Special tool blocks are used, with extra tool slots or easily adjusted tool holders to handle the complete range of parts. Work sequence includes rough-facing the gate, machining dovetail groove to accept brass seat ring, rolling in the ring, facing it off and chamfering it on the O.D. and I.D.

The rolling-in of the brass ring is particularly interesting. A special air-operated thrust bar, mounted on the end of the bedways, forces the ring into its machined seat. This setup eliminates additional equipment and operations, formerly required to bore the dovetails for mounting the seat rings and shrinking them into place.

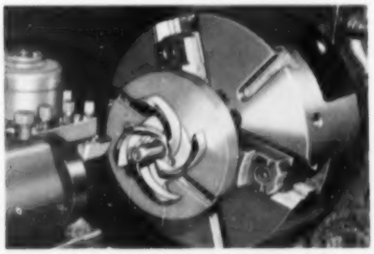


After workpiece is rough-faced and dovetail groove cut, operator sets brass ring in place prior to rolling in.

Floor-to-floor time is 8 min. for largest part, 3.7 min. for smallest. Special tool blocks minimize change-over.



Rolling-in operation, showing thrust bar rotated 90° to align with rolling-in tool block, and special short stop roll which permits mounting thrust unit at end of bedways.



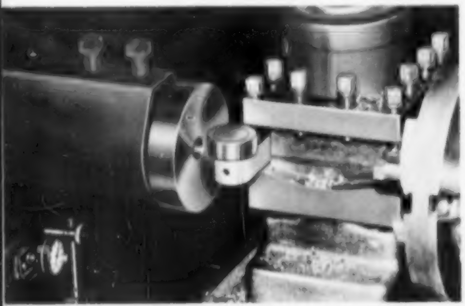
Six-degree angle generated on vane faces of pump impeller used in water-going M-59 Armored Personnel Carrier.

50% INCREASE WITH THIS SETUP

Arrangement permits angular facing cut to close tolerance

There may be a tip for you in the way Food Machinery & Chemical Corporation's Ordnance Division, San Jose, California, solved this problem: how to increase production of a phosphor-bronze pump impeller—requiring a difficult interrupted-cut facing operation—and eliminate breakage of form tools.

The solution was this unusual device—a tapered cam disc, mounted on one hexagon turret face of a No. 4 Ram Type Turret Lathe. Here's how it works: The hex turret ram is brought forward against a dial indicator for accurate end location and locked in place. A roller-follower, mounted parallel to the cutting tool on the square turret, is moved in to engage the cam disc. Then, using the cross slide carriage to hold the roller-follower against the face of the cam, the required angle is generated on the vane faces.



Cross slide carriage is guided by contact of roller-follower on cam disc. Note dial indicator for accurate length setting.

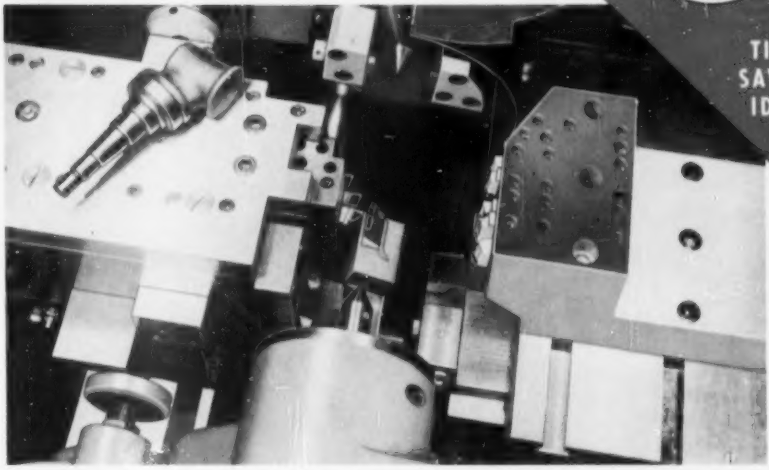
With this setup, the finished part is machined to a tolerance of .0015". Production was increased 50% on this job, and tool breakage was eliminated.

THE GISHOLT MASTERLINE

TIME-SAVING IDEAS

TWO TURNING OPERATIONS WITH 1 BASIC SETUP

Cam-operated auxiliary slide on No. 12 Automatic Lathe turns 6 diameters



Multiple tooling setup removes maximum stock in minimum time—over entire length of piece.

Perhaps you'll spot a production pointer in the way this customer is rough- and finish-machining steel steering knuckles with one machine—holding setup, tool adjustment and down time to the minimum.

The part is held between centers and driven by a face-plate driver. All six diameters are turned from three tools on an auxiliary slide mounted within the front carriage, which also mounts a flat cam to govern movement of the auxiliary slide.

The two lead tools turn the two largest diameters. The third tool, governed by the cam, turns the other four, including the taper. A separate tool-carrying holder—attached to the front carriage base and extending under the workpiece toward the headstock—carries three chamfering tools. Tools on the rear independent slide finish all of the fillets, shoulders and reliefs.

For the first operation, chamfer tools are removed from the front tool holder and one radius tool is removed from the rear slide. When the entire lot is machined, these tools are replaced; the front carriage is reset and rear slide feed stops are adjusted to finish dimensions, and the workpiece is finish-turned for grind. Floor-to-floor time for each operation is 0.9 min.

With this setup, customer has advantages of multiple tooling, with flat-cam operated auxiliary slide simplifying tool setting.

HOW CARTER MOTOR CO. SAVES TIME, CUTS BALANCING COSTS

Measures, corrects and inspects for balance in single handling

Your production costs can be materially reduced when measurement, correction and inspection for balance are performed in a single handling. Here's how it's being done at Carter Motor Co., Chicago, using a Gisholt 1S DYNETRIC Balancer.

The workpieces are Dynamotor armatures, produced in large quantities and used as a power source for many different types of two-way military radio equipment.

The parts are placed on the standard balancer work supports and rotated. The Direct Reading Amount Meter is calibrated so that one unit equals 1/16" length of 1/16" diameter solder. The stroboscopic light indicates the angle where the unbalance lies at each end of the part, and the meter tells exactly how much solder the operator should add in each correction plane.

The operator stops the machine and places the required amounts of solder at the indicated angles on the wire bands at the ends of the armature segments. Then the machine is started again and the operator flips two switches, one for each correction plane, to inspect for balance.

The Gisholt Balancer easily keeps pace with the rest of the production line, balancing all parts to low tolerances with ease and efficiency.

Any standard Gisholt Type S Balancer can be arranged to measure, correct and inspect for balance without removing the part from the machine.

◀ Operator ready to inspect part for balance. Tolerance is .001 ounce-inch in each correction plane. This is represented by one unit on the Direct Reading Amount Meter, and equals 1/16" length of 1/16" diameter solder.

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

MASTERLINE · GISHOLT SINCE 1887

TIME-SAVING IDEAS

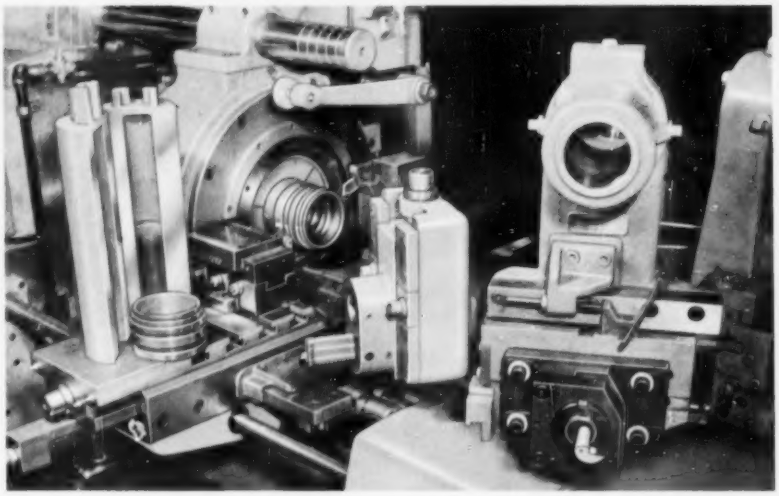
OVERMYER BOOSTS NECK RING PRODUCTION WITH FASTERMATIC

Automatic turret lathe cycle includes collet chuck and stock pusher operation

If you have exacting jobs like this—combining multiple-diameter machining with close-tolerance grooving and forming operations—you'll see why Overmyer Mould Co., of Greensburg, Pa., finds MASTERLINE 2F Fastermatics ideal.

Here's Overmyer's setup with the automatic turret lathe tooled to handle a variety of cast iron neck ring moulds. Special equipment includes a 6¼″ capacity, hydraulically operated, parallel-closing type collet chuck, mounted on a special steady rest. Ring stick castings in two sections are inserted in the collet and chucked on the O.D., which has been previously machined.

A push button actuates an overhead-mounted, swinging locating-stop, feeds the stock out to length and closes the collet. Another push button retracts the stop. With the overhead stock stop, all six turret stations can be used—to bore, form, groove, chamfer and face in the I.D. Tools in the magazine-type holder, mounted on the front cross slide, machine the entire O.D.... the finished part is cut off from the rear cross slide... and the cycle repeats.



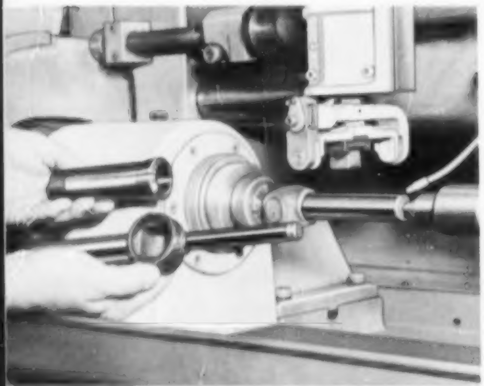
▲ Fastermatic — equipped with automatic swinging-locator, stock feeder and collet chuck—speeds work handling, assures consistent accuracy on close-tolerance neck ring moulds.

Two-segment workpiece, showing surfaces machined in this job. ▶

The neck ring mould shown here is completely machined in 4.9 min. f.t.f. Five parts are machined from each stick casting. Loading and unloading time for ring stick castings is only 0.4 minutes.

LOW-COST SUPERFINISH ON SHORT RUNS

Simple setup handles 2 diameters on piston rods



Collet holds on small, Superfinished diameter while large diameter is completed. Change-over requires only two sizes of collet and two Superfinishing stones.

You'll see ways to save from this typical setup—it reveals how modern tool rooms and job shops utilize Gisholt general-purpose Superfinishing machines to handle a wide variety of work.

The workpiece—a piston rod for a reciprocating pump—requires a low micro-inch finish to reduce leakage and extend packing life. It is 11″ long, with two different diameters extending 4″ each side of center to be Superfinished.

Tooling costs are held to a minimum. A standard collet holds the work on the large diameter. The smallest diameter is Superfinished first, using a tailstock support and formed stone. When the lot is completed, the collet is changed for the small diameter... the stone also is changed... and the large diameter is then Superfinished.

Both diameters are Superfinished from 80-100 down to 5-7 micro-inches R.M.S. Floor-to-floor time for each operation averages just 1 min.

Ample capacity, easy setup make 51A and 52A Superfinishers ideal for general-purpose work—on long or short runs. Automatic rough and finish cycle provides finer finish in less time, with minimum attention from the operator.

No. 1-257
671

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

PRINTED IN U.S.A. 12-56

GISHOLT MACHINE COMPANY   **Madison 10, Wisconsin**

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

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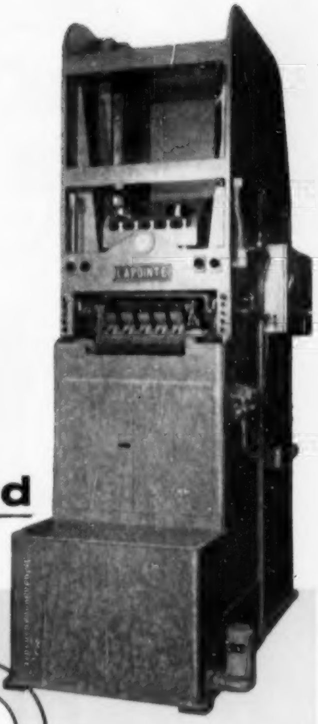
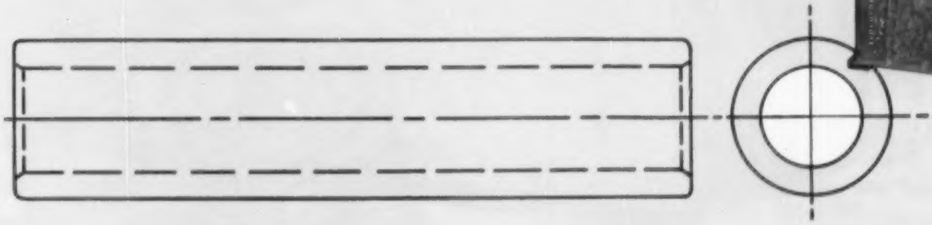
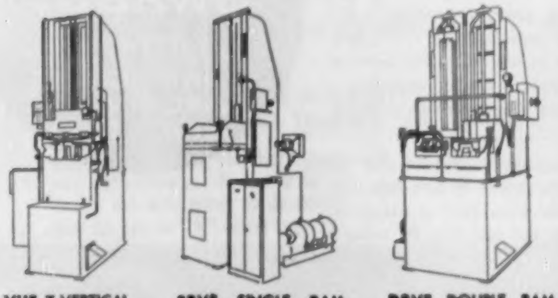


AUTOMOTIVE PISTON PINS

as the standard...the best method of finishing the inside diameter!



Broaching 5 parts at a time, this machine uses a LAPOINTE-built hydraulically operated fixture which is readily adjustable for the different diameter parts. Manually loaded. After broaching, the pins are released into delivery chutes. Machine uses a 48-inch stroke, and broaches at a speed of 40 feet-per-minute. Stock removal is 1/16". During the broaching stroke, the machine is completely closed in front, affording complete protection to the operator from oil spray; on the return stroke the oil flow is stopped.



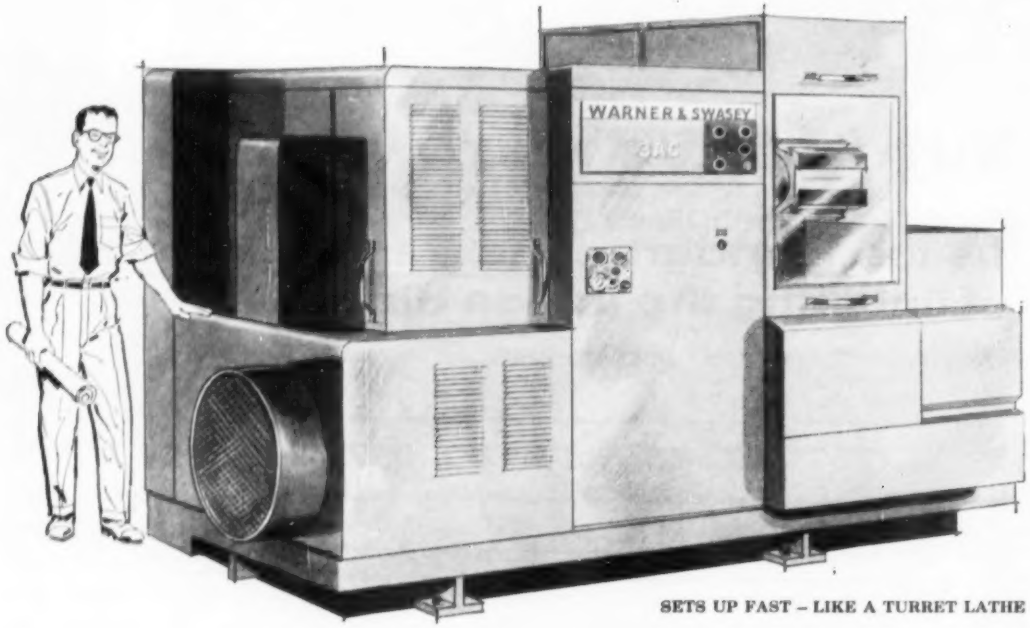
VUE-7 VERTICAL PULL-UP ELECTRIC — SRVE SINGLE RAM VERTICAL, ELECTRIC — DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

NEW...



SETS UP FAST – LIKE A TURRET LATHE

Warner & Swasey 3AC Single Spindle Automatic Chucker widens field of profitable turning jobs

This versatile, new model was engineered for fast, automatic machining of your larger, complex chucking jobs. It provides accuracy, metal removal capacity, tooling flexibility and set-up ease and speed heretofore unobtainable by automatic operation in this work range.

For over eight years, enthusiastic users have told us, "Performance records of our Warner & Swasey Single Spindle Chucking Automatics have been phenomenal."

The 1AC model, first introduced at the 1947 Machine Tool Show in Chicago, met with instant field acceptance. In 1953—88 customers placed orders for the 2AC model before the first machine was ever built!

Now, Warner & Swasey announces a new, larger capacity, more powerful 3AC model with a 15-inch diameter chuck and a 40-horsepower motor, which will provide fast, automatic production for your larger pieces — precision and otherwise — in all lot sizes.

Our Field Representative will be glad to give you complete details on how this new machine can increase profits on your operations. Why not call him in, today?

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

No Matter Which Way You Turn . . . Warner & Swasey Cuts Costs

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-24

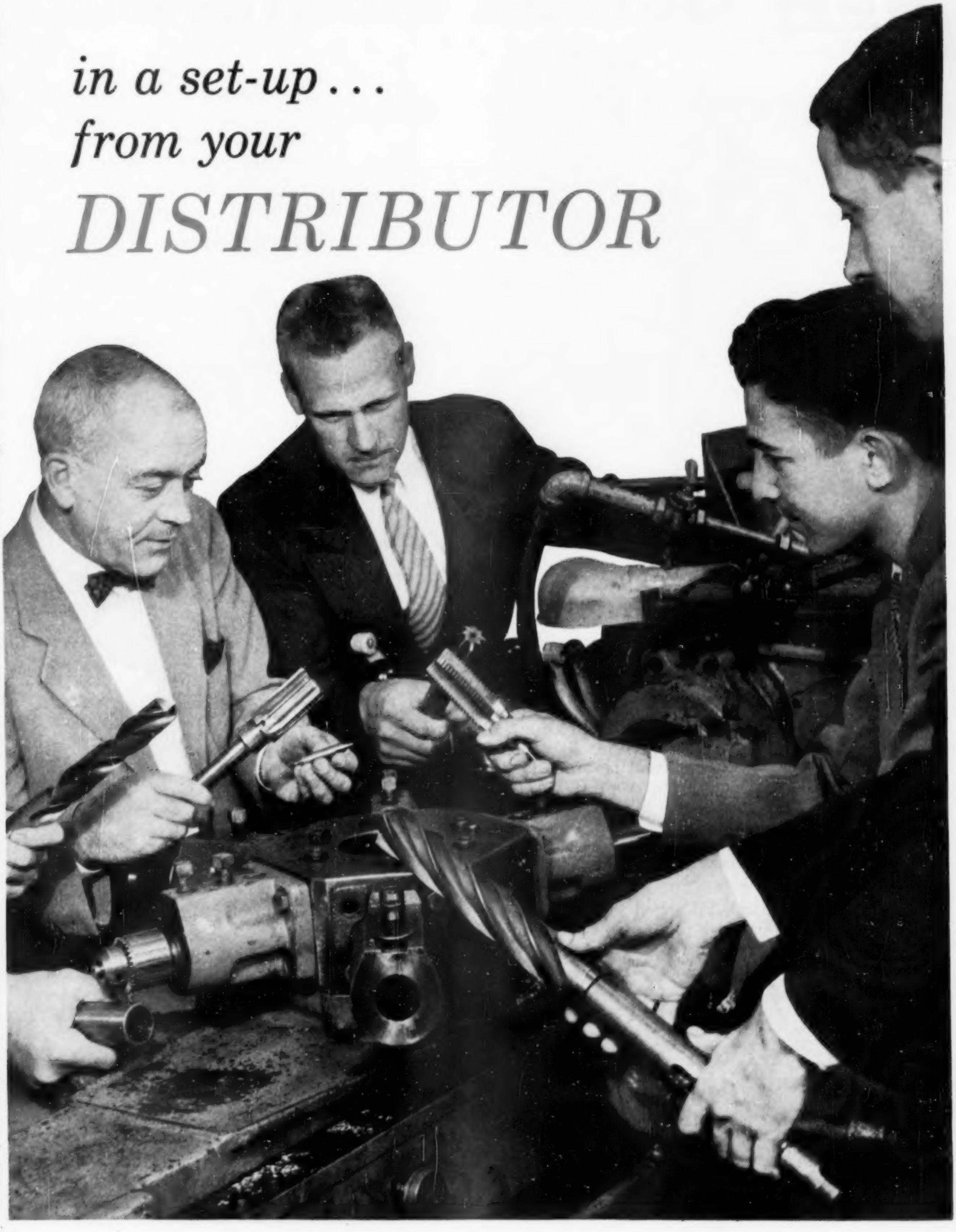
No matter how many cutting tools You can get the "whole package" MORSE-FRANCHISED

Take a close look at this set-up and you'll see these 7 tools: Center drill, cobalt drill, carbide core drill, facing and turning tool, roughing reamer, finishing reamer, tap.

One man supplied all seven tools. And he, of course, is your Morse-Franchised Distributor . . . your only source for all the varied requirements of a complete tooling job like this. And the job is protected . . . *results insured* . . . by Morse Quality in every single tool. So call in this "1-man team" today . . . he makes Morse Tooling pay *all ways.*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

in a set-up . . .
from your
DISTRIBUTOR



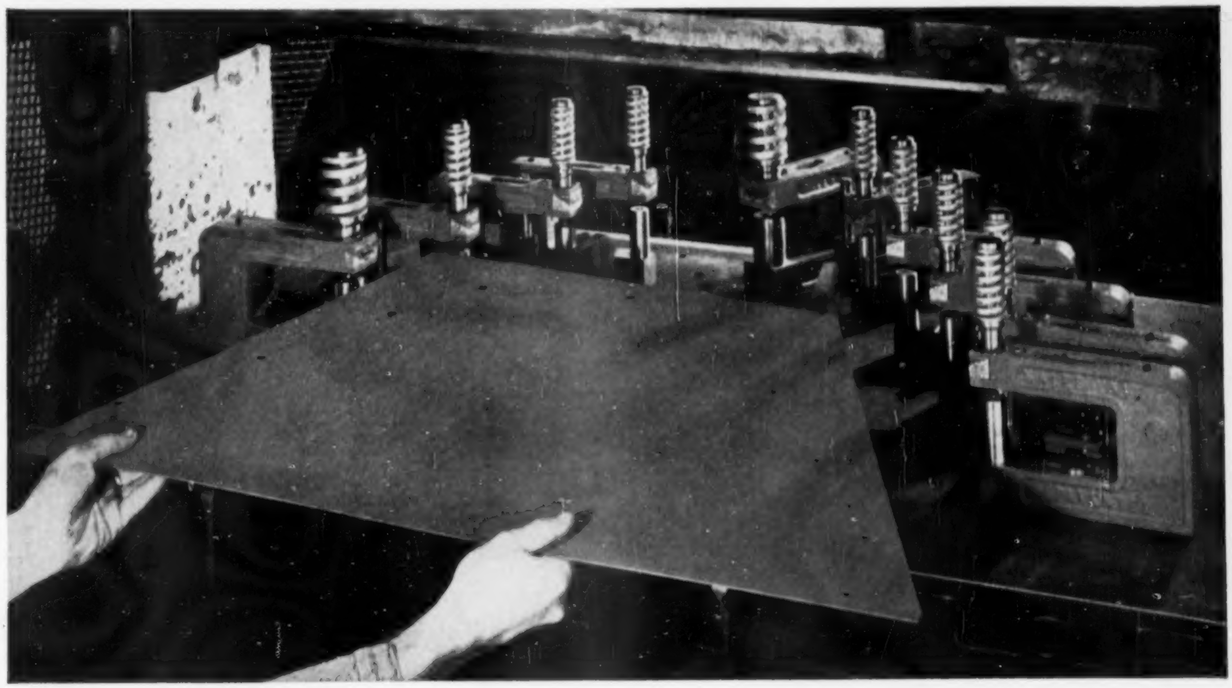
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-27

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Omega Punches, Used in Multiple Units, Provide Big Savings in Metal Punching

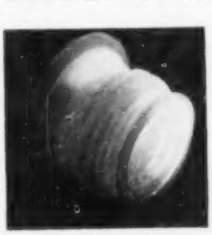
If you'd like to see some interesting metal-punching jobs, the place to visit is Wales-Strippit Company, at North Tonawanda, N. Y. There they employ about every punching operation imaginable, using self-contained punching units which are set up quickly to meet the requirements for varied hole sizes or shapes.

One of the tool steel grades which has been doing a fine job of minimizing shop costs at Wales-Strippit Company is Bethlehem Omega, a super-tough steel supplied by Leed Steel Co., Buffalo. Omega's dependability and long service life have been remarkable . . . all the more so because it is used exclusively in punching hard metals, where high shock-resistance heads the list of requirements.

Omega is our "super" grade of oil-hardening, shock-resisting tool steel. It can also be quenched in water. Here's its typical analysis:

C	Mn	Si	Mo	Va
0.60	0.70	1.85	0.45	0.25

Omega isn't limited to service in punches, either. It's just what the doctor ordered for hand and pneumatic chipping chisels, knockout pins, swaging dies, shear blades, and other uses where the steel is continually subjected to severe shock.



Making Plastic Parts? Use Lustre-Die

Lustre-Die, our new plastic-molding tool steel, is really something! What a high polish it takes! And what high lustre you get on tne finished parts! Lustre-Die has a well-balanced analysis, and is alloy fortified to increase its depth of hardenability and mechanical properties. It's good steel. You'll like it.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

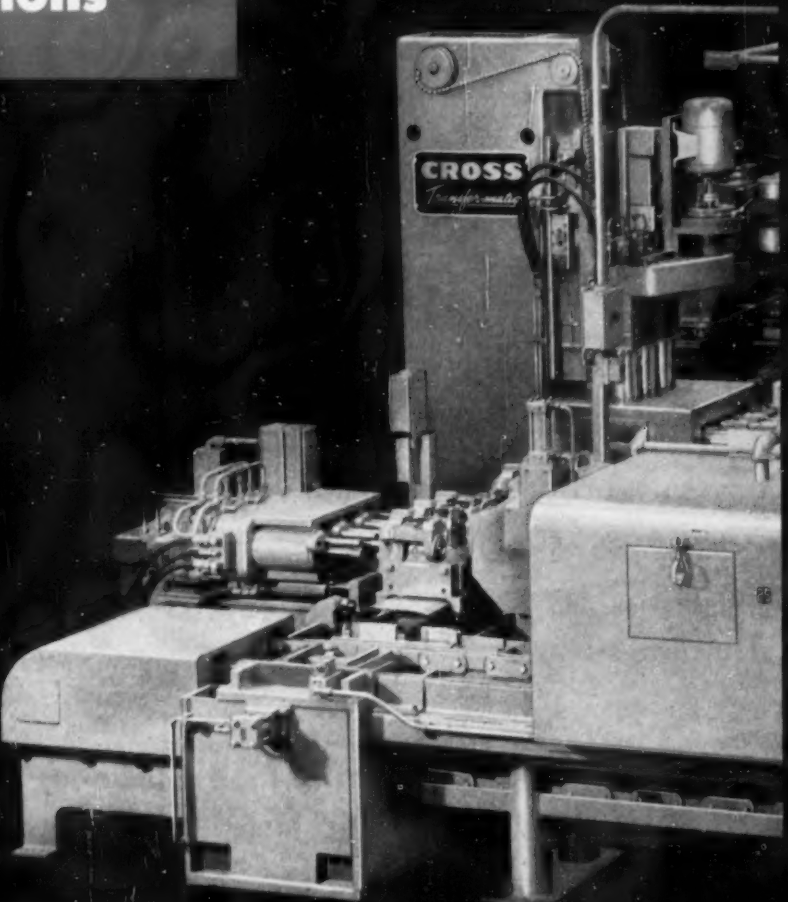
Oxide Skin Improves Lehigh H

Most users of hot-work steels know that the oxide skin, put on the surface of tools by the second temper, is beneficial. This oxide coating serves partly as a lubricant, and also helps conventional lubricants to adhere, thus increasing wear-resistance.

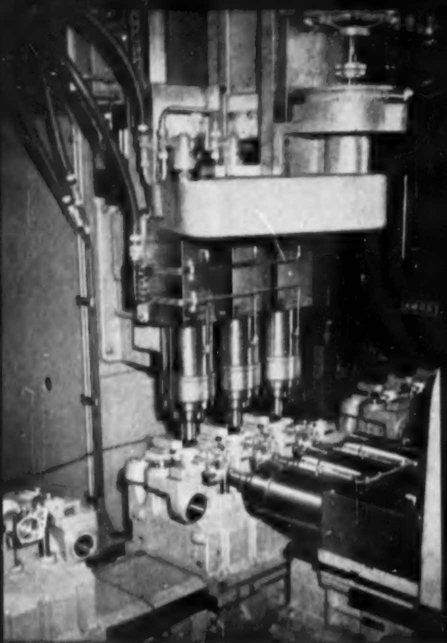
When tempers above 900 F are used, Lehigh H tool steel is also benefited in the same way by the oxide coating resulting from the second temper. Here is the sequence of operations to be followed in heat-treating Lehigh H, so as to take advantage of the oxide coating:

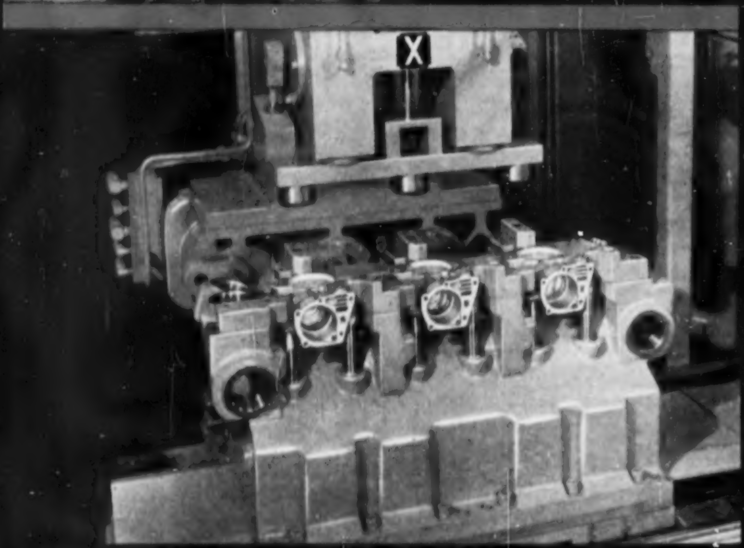
1. Heat the tool and quench it in the conventional manner.
2. Temper at 925 F (or higher for some purposes).
3. Grind the tool to size, and remove scale and decarburization.
4. Retemper the tool at 900 F. Do not grind or remove the light oxide coating—use the tool with this surface.

Completely Machines Servo Valve Bodies for Automatic Transmissions

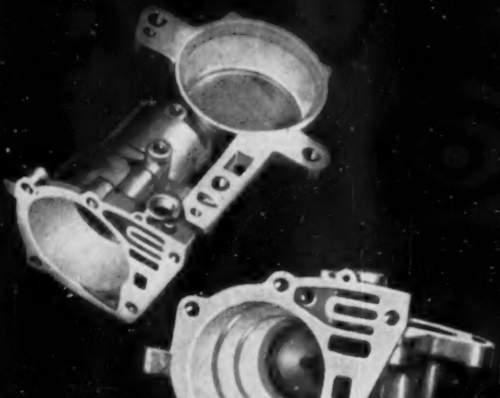


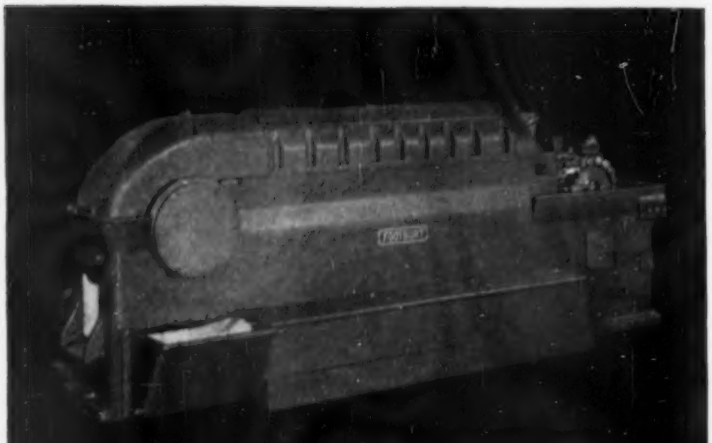
The final precision boring station.





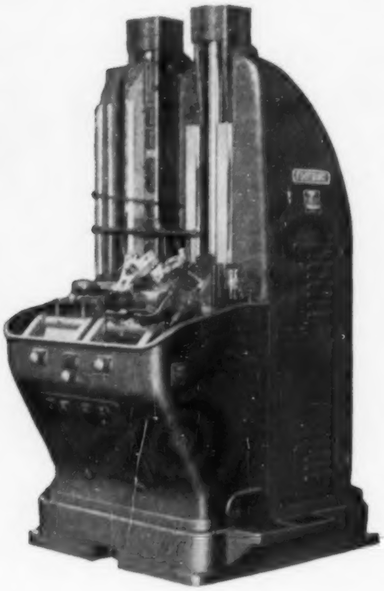
The loading station. Part locations are checked automatically by Unit X to assure proper clamping.





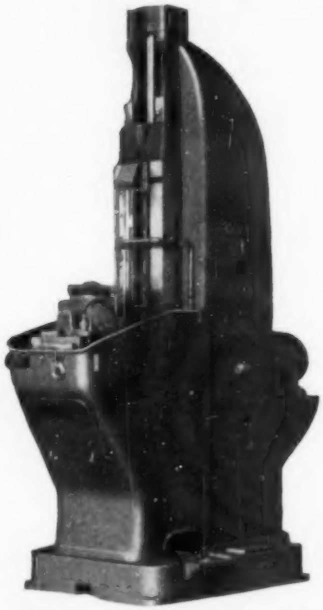
Continuous Type Broaching Machine. Made in 5 Sizes.

Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.



FOOTBURT

a faster *More Economical* machine operation



■ Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio • Detroit Office: General Motors Building

Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

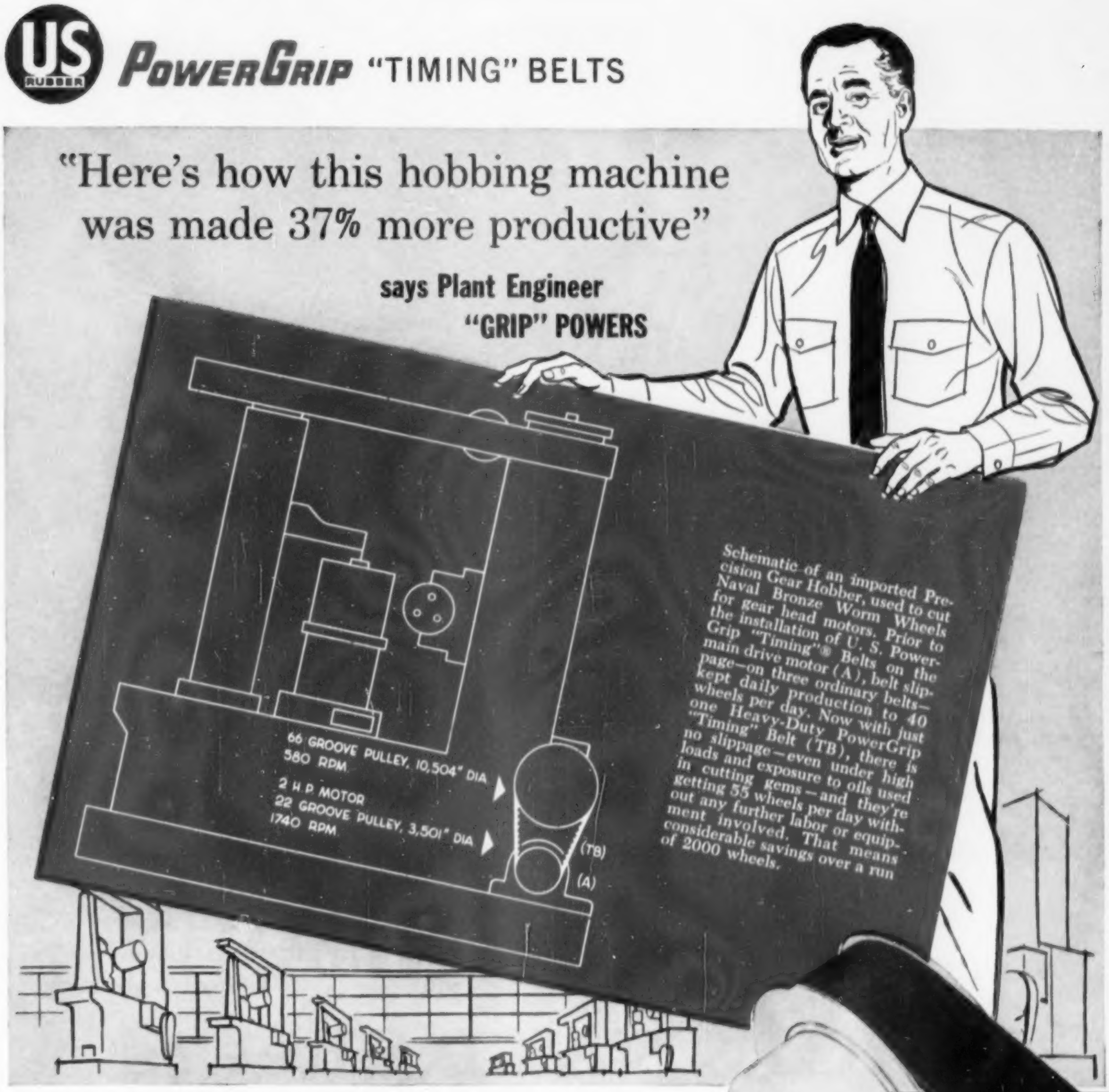
FOOTBURT

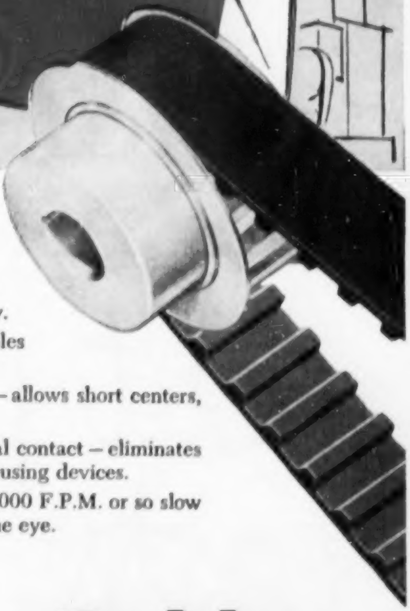
PIONEERS IN SURFACE BROACHING

US RUBBER ***PowerGrip*** **"TIMING" BELTS**

"Here's how this hobbing machine was made 37% more productive"

says Plant Engineer "GRIP" POWERS





"Grip" Powers is showing you a true story of how one East Coast gear manufacturer utilized the unique ability of U. S. PowerGrip "Timing" Belts to step up production. It's just one of many examples of how U. S. PowerGrip "Timing" Belts simplify and improve a power transmission unit.

For the design of hand tools, drill presses, saws, electric typewriters—from fleapower to 1,000 horsepower—get U. S. PowerGrip "Timing" Belts.

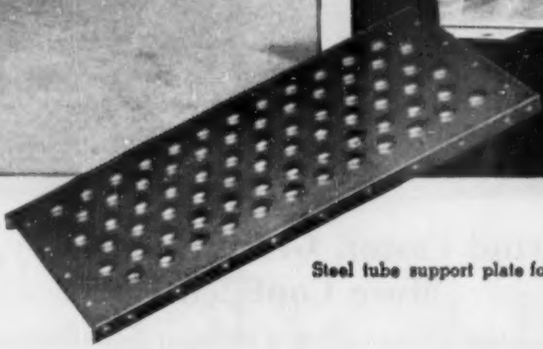
These belts—plus expert engineering service—are obtainable at the 28 "U. S." District Sales Offices, "U. S." power transmission distributors, or contact us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

U. S. PowerGrip "Timing" Belts offer all these advantages:

- close to 100% efficiency.
- constant angular velocity.
- imbedded with steel cables for high tensile strength.
- no slippage, no take-up—allows short centers, high ratios.
- absence of metal-to-metal contact—eliminates need for lubrication and housing devices.
- handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.

Mechanical Goods Division

United States Rubber



Steel tube support plate for cooling coils.

Three Cincinnati Shears and four Cincinnati Press Brakes are profitable producers in this finely equipped shop.

The battery of shears produces accurate blanks, sheared to micrometer accuracy, which are later formed and pierced on the Cincinnati Press Brakes.

The photo at left shows multiple holes being pierced and extruded to a tolerance of $\pm$.002" in a steel tube support plate for Trane cooling coils. On this operation alone, floor to floor time ***was cut from 3-1/3 minutes to 1/2 minute*** by the use of Cincinnati Press Brakes. The speed and outstanding accuracy of these Cincinnati Machines have lowered costs and increased quality of the air conditioning equipment manufactured by this leading company.

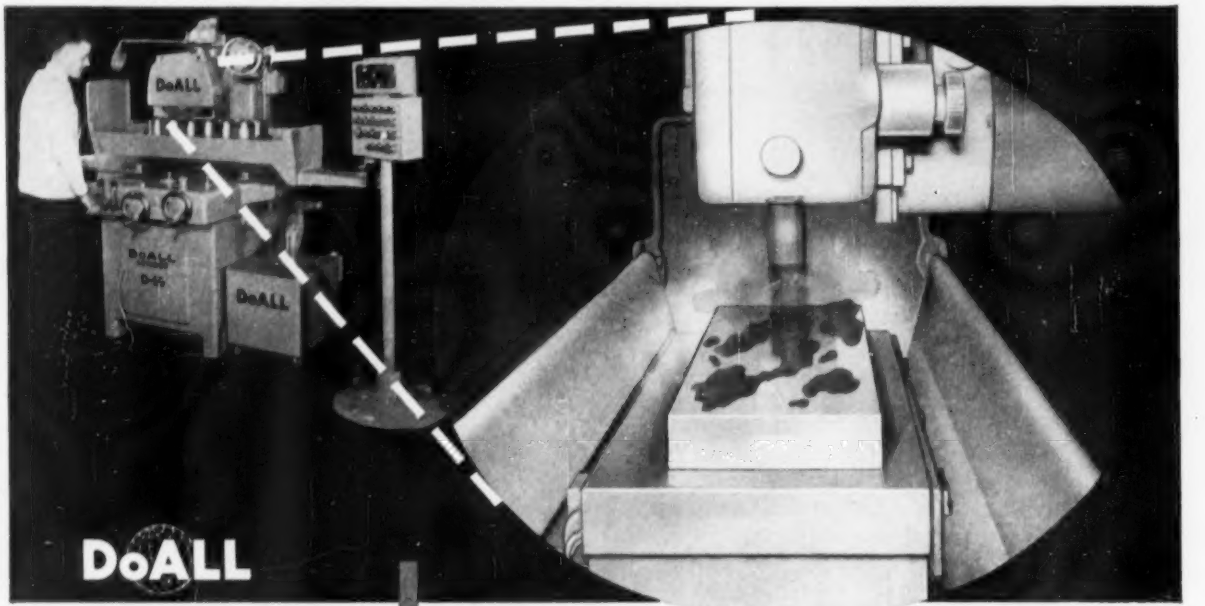
Write **Department E** for Catalog S-7R on Cincinnati All-Steel Shears and Catalog B-4R on Cincinnati Press Brakes. We also suggest you consult our Application Engineering Department about your shearing and forming problems.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

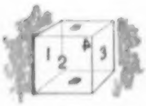
CINCINNATI

"Cool Grinding" Proves 1000 Times More Effective than Flood Cooling

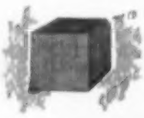


Grind Faster, Grind Accurately, More Confidently

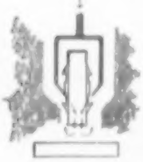
Mist Provides 1000 Times More Heat Absorbing Surface



A cubic inch of coolant offers six square inches of heat absorbing surface.



Atomized, each of the 1,000,000,000 cubes offers .000006 square inches of surface or total of 6,000 square *inches* over all.



In "COOL GRINDING" coolant is fed to the sides of the wheel. Centrifugal pump action draws the coolant into and through the wheel. It emerges atomized, right at cutting edge.

Atomized coolant, as shown at left, is 1000 times more effective as a heat absorbent than liquid coolant. "Cool Grinding" puts this atomized coolant directly at the point of work-wheel contact. Temperatures are reduced as much as 1300°F as compared to flood cooling.

Aids Precision in Grinding—Efficient heat dissipation prevents expansion —helps assure close control of dimension and parallelism.

Ground Parts Last Longer—"Cool Grinding" eliminates burning, checking and stresses—a source of premature failure of ground parts resulting from high heats and quick quenching.

Increased Production—Grinding can be done at faster rates, without heat expansion or damage.

Dry Grinding Visibility—Mist does not obscure work, visibility is unlimited.

Wheel Life Increased—Continuous flushing and cooling action *in* the wheel greatly increases its life.

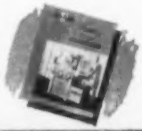
Standard Grinding Wheels—No need for wheels with "special" arbor holes.

Coolant Recirculates—Saves on coolant. Special filter cleans the coolant before reuse.

Free In-Your-Plant Demonstration—DoALL will bring a grinder to your plant and show you how to increase your grinding profits. Write: **The DoALL Company, Des Plaines, Illinois**

FREE MOVIES—Sound and color to show you the ultimate in precision grinding. Call DoALL locally or write.

FREE CATALOG—Shows design and construction of DoALL Grinders and accessories including "Cool Grinding".



Friendly DoALL Sales-Service Stores In 38 Cities.

Cool Grinding U.S. Pat. No. 2470350

GR-17

NEW DESIGN in HONING TOOLS provides

improved wear characteristics

greater abrasive support

for bores up to 4"

This new BarnesdriL Honing Tool design means more efficient honing operations because it supplies better abrasive wear characteristics and greater strength at the point of cutting. The tool has very few parts in its simple construction, and may be designed for use with either a floating or rigid fixture. BarnesdriL wing-type abrasive stones are press-fit between standard hardened inserts which act as side supports for the stones as well as guides in the bore. Fiber jackets reduce stone wear by protecting the inserts against the abrasive and serve to hold the wing-type stones firmly in place.

Fully protected by patents, this new honing tool will improve your honing operations and reduce honing tool costs on honing operations. See your BarnesdriL representative, or send us prints of your honing operations for recommendation.

few parts

quick-loading

simple construction

low tool maintenance

easy stone-replacement

50th year

BARNES DRILL CO.

870 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-38


Staples
ROTATING CARBIDE TOOLS
Old skills modern facilities give you premium Carbide Tool performance
What makes a carbide tool outstanding?
Staple's answer: Ultra-modern facilities in the hands of the finest Cincinnati craftsmen. Your assurance of a new kind of carbide tool performance—whether special or standards!
1. Stub Screw Machine Reamers (Solid and Expansion Types) 2. Expansion Reamers (Patented) 3. Shell End Mills 4. End Mills 5. Twist Drills (solid and tipped) 6. Core Drills 7. Solid Chucking Reamers 8. Counterbores, Spotfacers.
THE Staples TOOL COMPANY
2352 Glendale—Milford Road
Evendale, Cincinnati 15, Ohio
1
2
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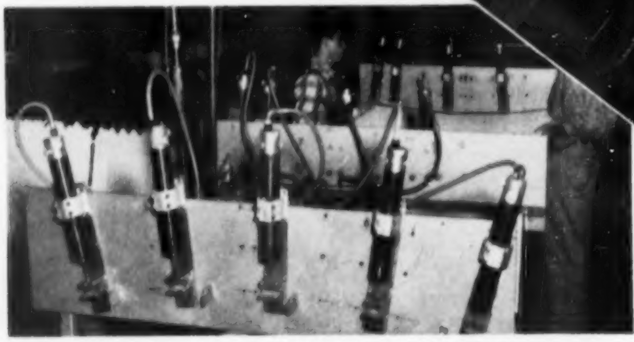
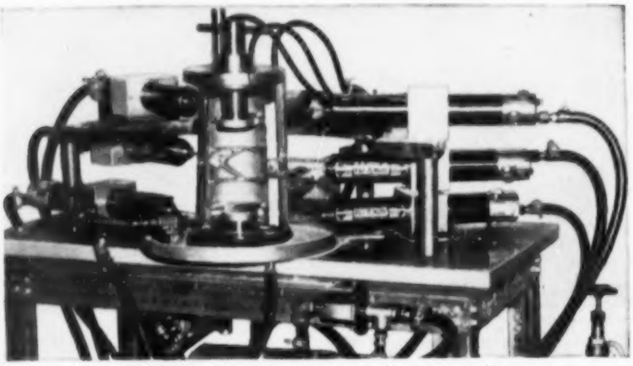
8

Save on Holes!

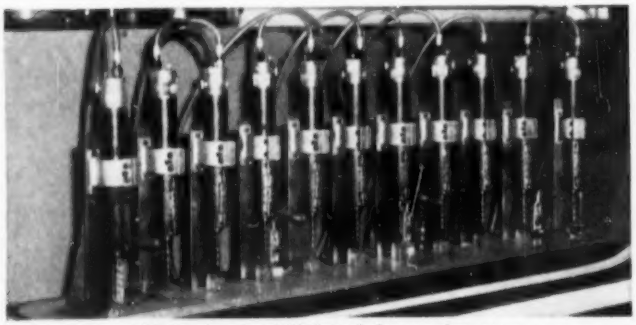
ONLY $175^{00}



ARO Par-A-matics drill 3/16" and 5/32" holes in sub-assemblies of aluminum awnings.



Eight holes are drilled in a cast aluminum sanding drum in 4 to 5 seconds with ARO Par-A-matics.



ARO Par-A-matics drill eleven holes at a time, automatically, in curved molding strip for automotive trim.

SWITCH TO ARO PAR-A-MATIC DRILLING UNITS

LOW INVESTMENT . . . You can drill any number of holes simultaneously, at *extremely low cost,* with ARO Par-A-matic Drilling Units!

LOW MAINTENANCE . . . Par-A-matics are air-operated . . . simple to set up and maintain . . . precision-made . . . performance proved.

LOW CENTER-TO-CENTER DISTANCE . . . compact design permits use where space is a factor.

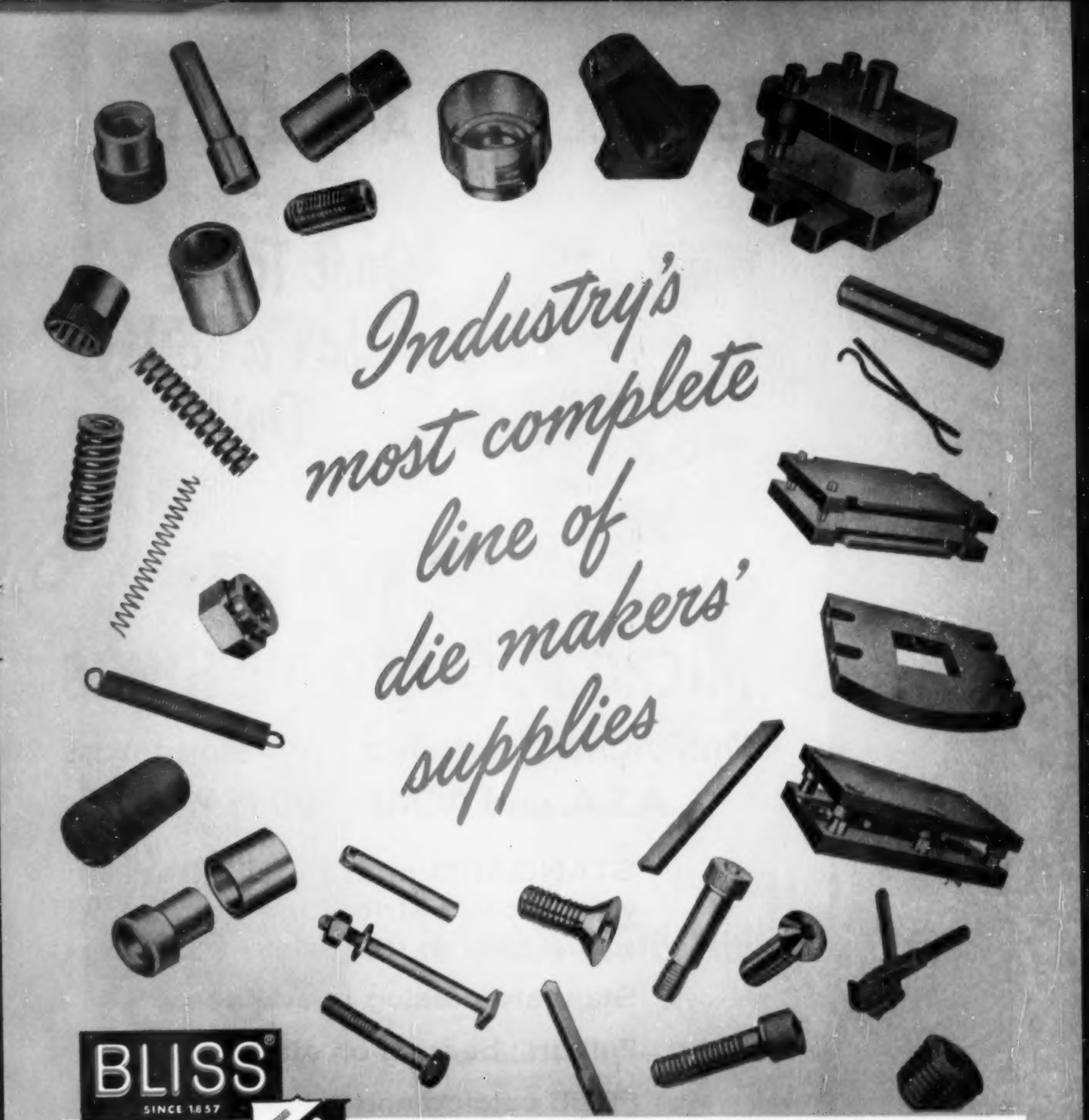
FLEXIBILITY OF SET UP . . . Adjustments are quick and simple. Adjustable stroke length . . . variable rate of feed. ARO Field Engineers offer full assistance in planning multiple Par-A-matic installations. Write for bulletin 5546-T.

THE ARO EQUIPMENT CORPORATION, Bryan and Cleveland, Ohio
Aro of California, 4131 S. Grand Ave., Los Angeles 7
Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ARO® **AIR TOOLS**

Also . . . Air Hoists . . . Lubricating Equipment . . . Aircraft Products . . . Grease Fittings . . .

FOR FURTHER INFORMATION, USE REA[illegible]ER SERVICE CARD; INDICATE A-1-42



E. W. BLISS COMPANY

DIE SUPPLY DIVISION

1400 Brookpark Road, Cleveland, Ohio

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GROUND MULTIPLE THREAD MILLING CUTTERS
FORM RELIEVED MILLING CUTTERS
SINGLE POINT TOOLS
FORM TOOLS
BROACHES
FACE MILLS
CONTINENTAL DRIVE TOOLS
Newest Materials and Methods-
Plus the Toughest "Proving Ground" in Industry
What makes one tool better than another? Most engineers boil it down to these three factors: (1) careful selection of the newest tool materials, (2) proper tool design, (3) accurately controlled heat treatment.
Continental is constantly testing these three factors in one of the toughest tests in industry: the rugged day-in, day-out torture of actual production in Ex-Cell-O plants.
The results of Continental engineering and testing will be evident in your own cutting tool operations. Call your Ex-Cell-O representative or contact Continental direct.
CTW
Continental TOOL WORKS
Division of Ex-Cell-O Corporation, Detroit 32, Mich.
56-47

Here's the NEW SIMONDS "Easy Access" (100′ COIL) METAL CUTTING BAND SAW PACKAGE

Makes it easy to remove or retract any length of blade . . . Saves your fingers . . . Protects the teeth . . . Holds 100 lineal feet.

There's no "fighting the box" or tearing your fingers with this new, easy dispensing Simonds Band Saw Package. Its special design makes it easy to pull out any desired length of blade *and retract any excess* without straining or nicking your fingers on the sharp points of the teeth.

Look for . . . ask for . . . this handy new 100′ coil package now!

Specify SIMONDS for all your Metal Band Saw needs . . .

- Standard Tooth (Regular or Wavy Set),
- Sabre Tooth (with a hook), Skip Tooth,
- Spring Temper, High Speed Steel

. . . for longest life and lowest cost on contour, cut-off or general purpose work.

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

For Fast Service from Complete Stocks Call your **SIMONDS Industrial Supply DISTRIBUTOR**

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-48

Acme-FETTE

...cuts costs... ROLLS better threads... faster

JOB FACTS: Rolling a $\frac{5}{8}$"-18 thread in C-1117 steel on a Type N-2 self-opening Acme-Fette Thread Rolling Head.

even on this short run

threading costs reduced from 50 cents to 1 cent per piece

As reported by Mr. Arnold Thompson, President, Thompson Tool and Manufacturing Company, Franklin, Ill., manufacturers of the "Dress-O-Grind" grinding fixture.

When thread chasing failed to provide the required finish for this Class 3 thread fit air rotor—and thread grinding proved too costly—this manufacturer turned to *thread rolling*, using the versatile* new N-2 Acme-Fette Self-opening Thread Rolling Head, on a hand screw machine.

"As a result," states Mr. Thompson, "on a test run of only 1000 pieces, our threading cost dropped from 50 cents to one cent per piece . . . and we maintained the finish we had to have throughout the run, without a single adjustment."

While the Acme-Fette Thread Rolling Head has built its reputation on long runs (often running into the millions) don't overlook the many advantages it offers—*even on short runs!*

*THREADING FROM THE END IS NOW POSSIBLE ON YOUR PRESENT ROTATING OR NON-ROTATING SPINDLES

•

Provides smooth, extremely accurate and tougher threads—*without chips*—up to 5 times faster than *thread cutting* methods.

National Acme

THE NATIONAL ACME COMPANY, 184 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

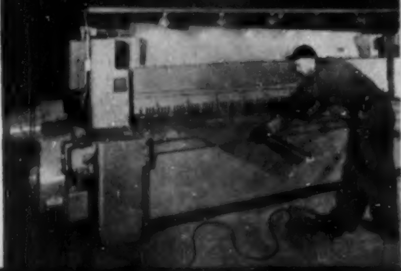
see what America's most modern power

SHEAR USERS EVERYWHERE TELL THEIR STORIES OF NIAGARA BENEFITS

(3 of 19 Photo-Reports shown in Niagara's new Bulletin 69G)

"an exceptional machine value"
— World's Largest Trailer Mfr.

"For over 10 years . . . we have never had any downtime for repairs and maintenance."
— V-Belt Pulley and Caster Mfr.



"High quality of accuracy with the utmost in speed and performance"
— Midwest Road Machinery Mfr.

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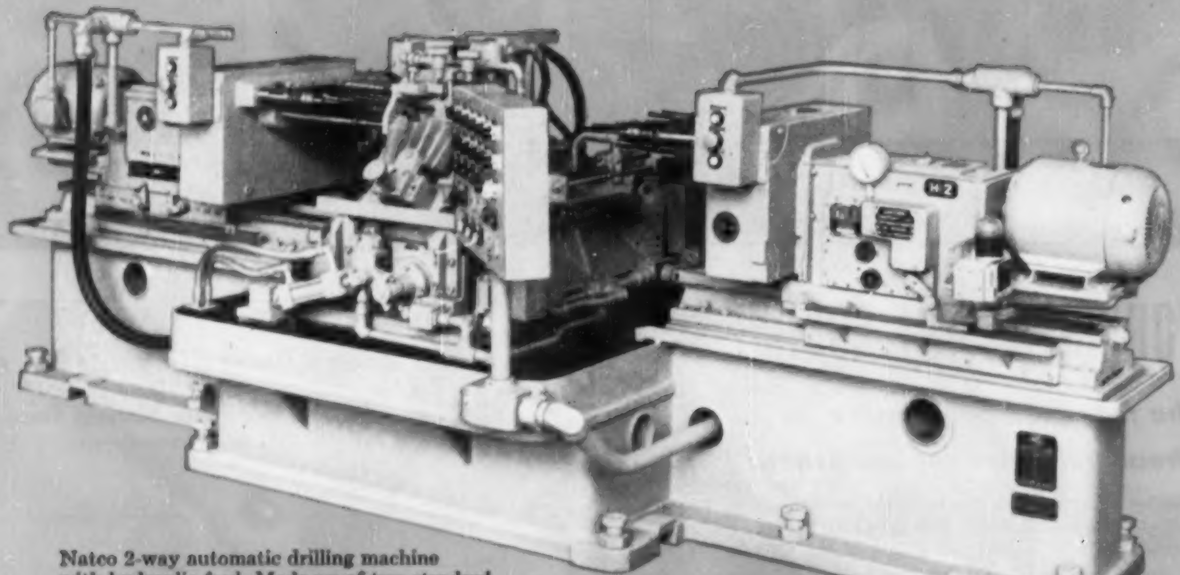
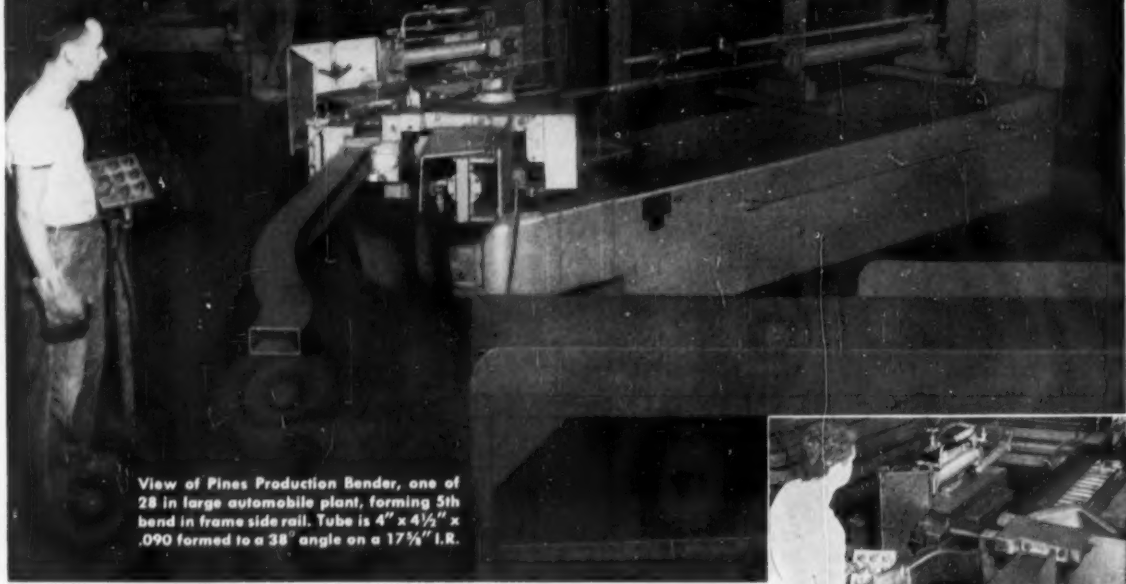


Natco 2-way automatic drilling machine with hydraulic feed. Made up of two *standard* units, both having hardened and ground steel ways, automatic lubrication, automatic time delay and positive stop.

Now-COLD BENDING THE "PINES-WAY" PRODUCES MORE ACCURATE AUTOMOBILE FRAMES



View of Pines Production Bender, one of 28 in large automobile plant, forming 5th bend in frame side rail. Tube is 4" x 4½" x .090 formed to a 38° angle on a 17⅝" I.R.

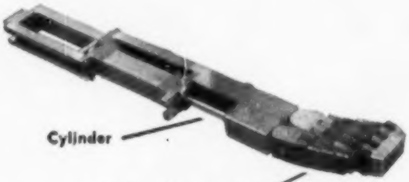
▲ Close-up view of machine used to produce 4th bend in long side rail member. Five different bends are made in this piece, each in sequence on separate machines. Accuracy is held within .030" to .045" at seven check points. Spring-back is easily controlled by simple stop settings — an important factor that cuts tool costs.

Production Bending Methods Simplify Fabricating Problems, Cut Assembly Costs

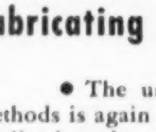
• The unusual versatility of Pines Bending Machine methods is again demonstrated by the successful production line application shown above in a large automobile manufacturer's frame plant. Proven by more than 18 months of operation, a battery of 28 special Pines Benders are now forming .090 tapered welded steel tube frame members at a rate of 120 bends per hour. These machines and ingenious tooling, designed and built by Pines, form a total of seven bends in each side rail member and produce more accurate parts than ever before possible. The end result is a stronger, more accurate chassis that is much easier to assemble to the car body.

Typifies Progress in Cold Bending Techniques

This revolutionary new manufacturing method is the result of long months of cooperative efforts between Pines and automotive engineers. It is typical of the consistant progress being made in profitable application of cold bending in the manufacture of a wide variety of metal products. It may also pay you to investigate the design possibilities and the production advantages of cold bending the "Pines-way." At your first opportunity call in our Sales Engineers for free survey.



▲ View of a flexible articulate mandrel used for making a bend at a right angle to, and within, a previously bent section. Mandrel is automatically inserted and expanded. Insures smooth, neat bends.



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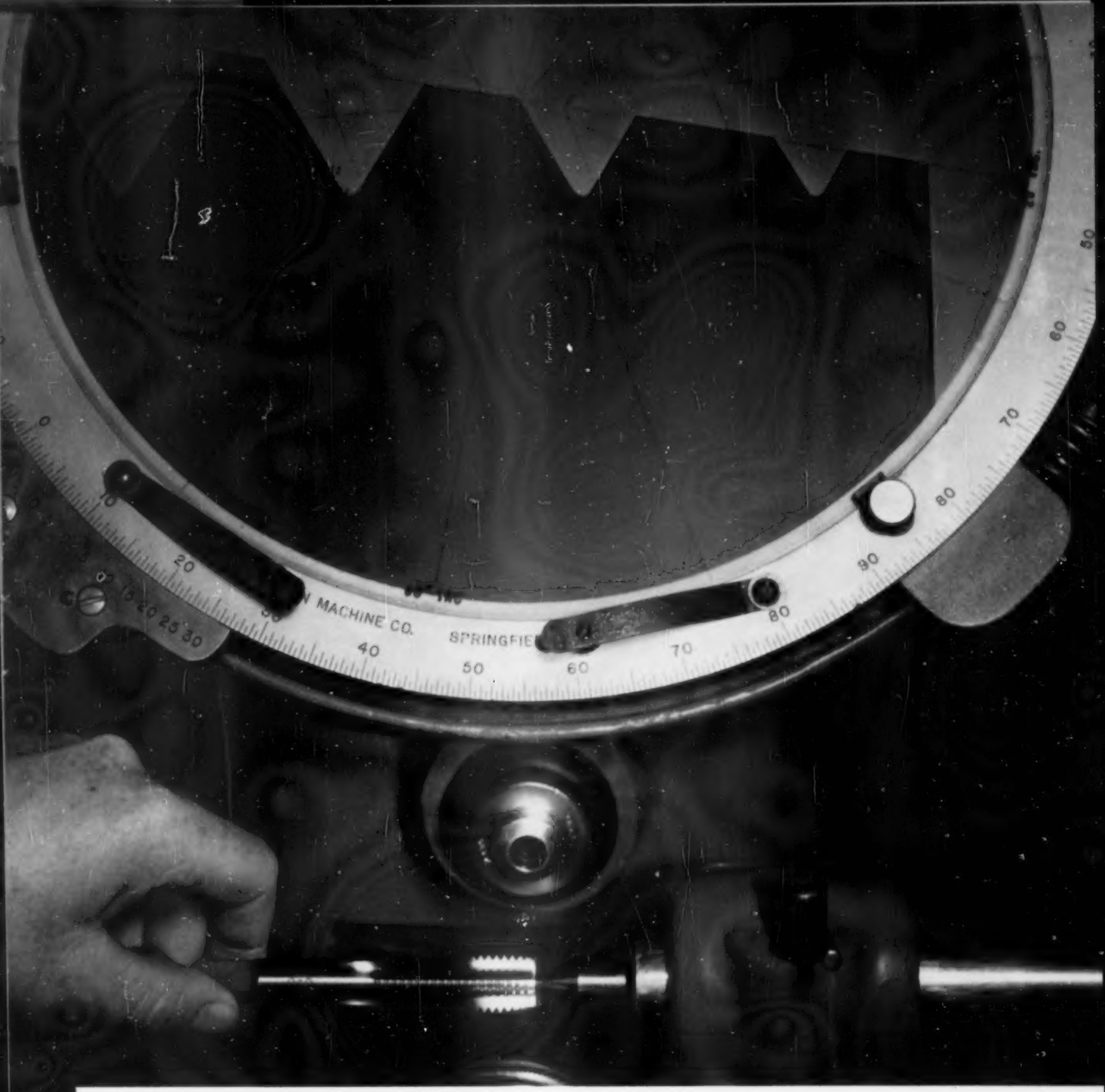

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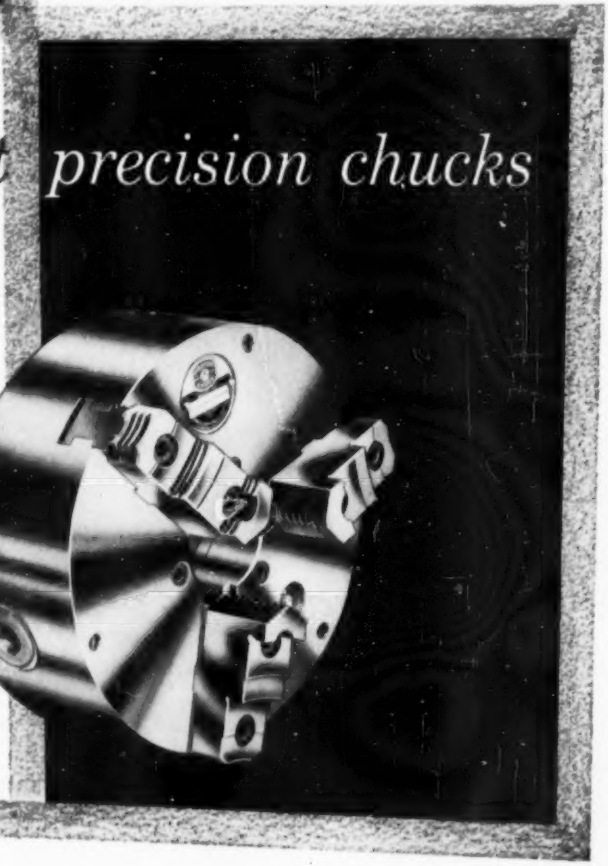
the finest high speed lathes

Photo courtesy
The Monarch
Machine Tool Co.

This is Monarch's Series 62 with Preselector Dyna-Shift designed to increase productivity and lengthen tool life. This fine lathe is typical of the quality machine tools built by Monarch. Write for Booklet #1505 for complete data. The Monarch Machine Tool Company, Sidney, Ohio.

deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for over 100 years has been the ideal complement to the world's finest tool room, general purpose and production lathes. Its precision and lasting accuracy make it a part of any production picture. For the complete story on this and Horton's complete line of precision chucks, see the Horton people in your area now.

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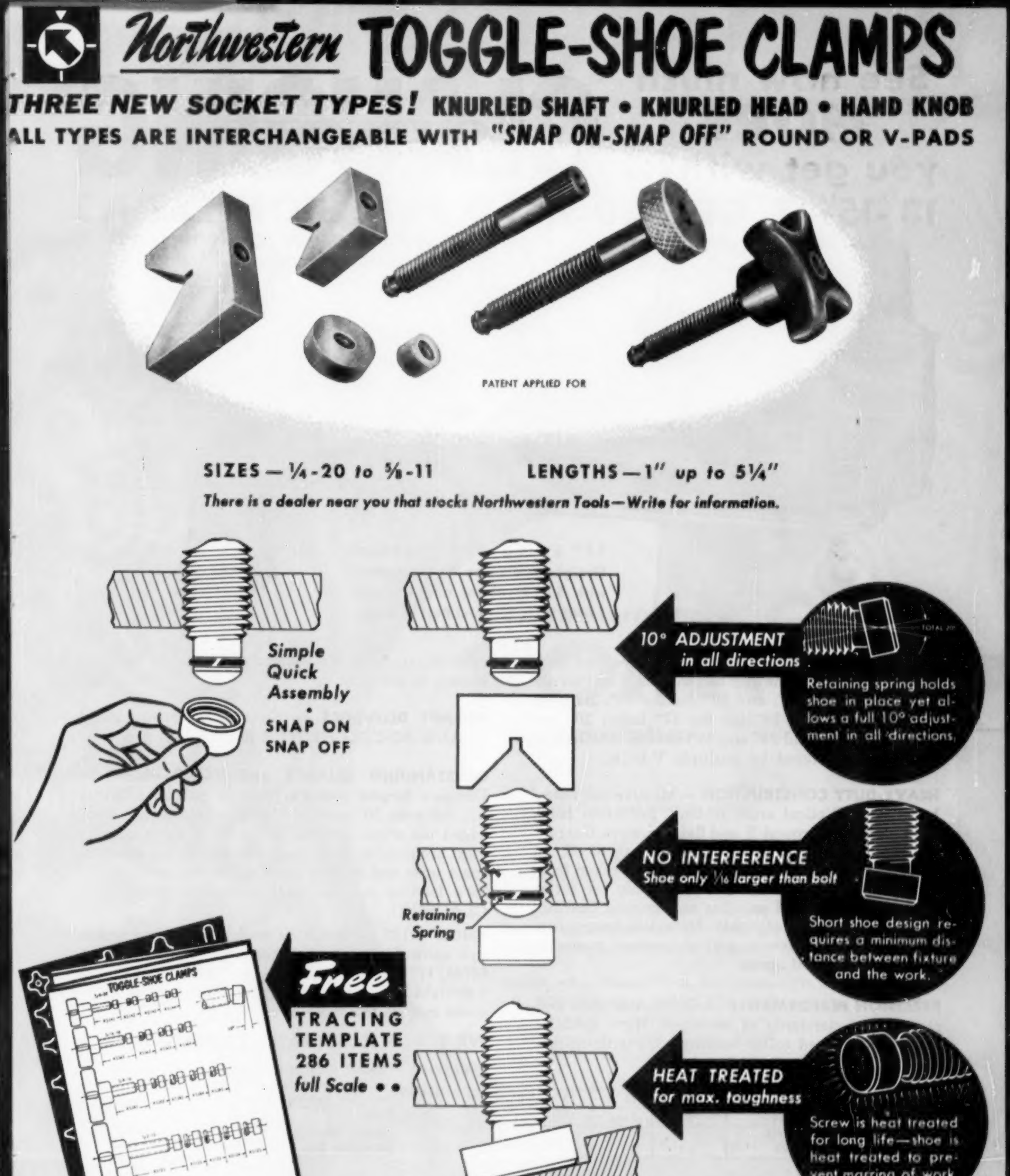
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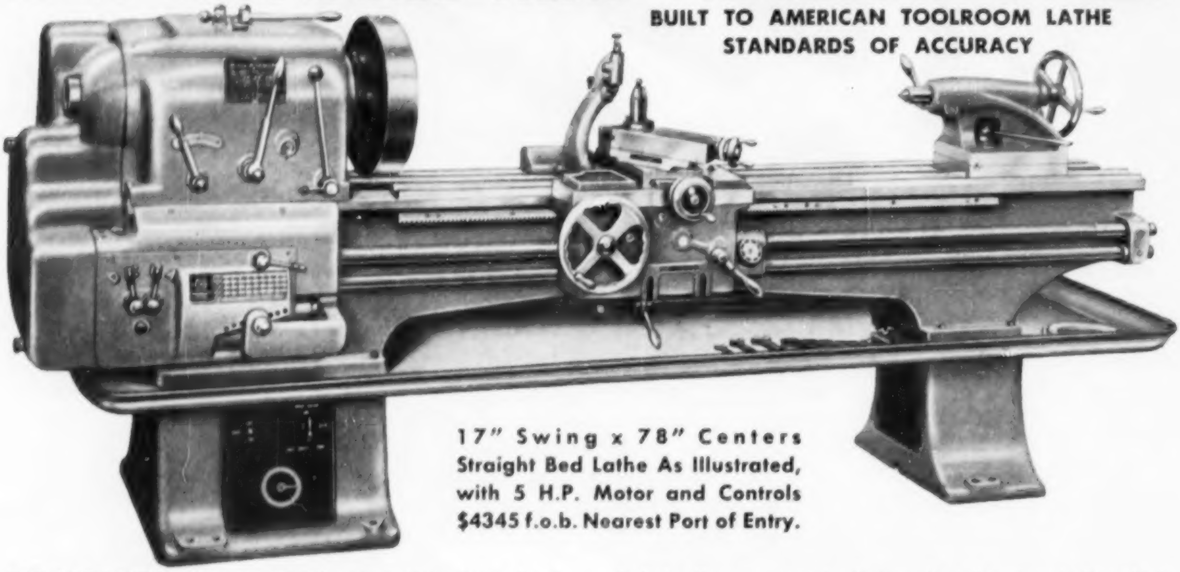

17" Swing x 78" Centers Straight Bed Lathe As Illustrated, with 5 H.P. Motor and Controls $4345 f.o.b. Nearest Port of Entry.

BIG CAPACITY — larger spindle capacities (see chart below). Swing for the gap bed models is 29" for the 17"; 25" for the 15"; and 19" for the 13". Between centers capacities: 78" for the 17" lathe; 30" and 48" for the 15"; and 24" and 36" for the 13". Geared-head drive powered by multiple V-belts.

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CAPACITY	17"	15"	13"
THRU-HOLE	3 1/16"	2 1/16"	1 9/16"
NOSE TAPER KEY DRIVE	L-2	L-1	L-0

BIGGER BEARINGS

GAMET MICRON precision taper roller bearings with oil flow lubrication . . . the most advanced and accurate bearings known to industry.

SIZE	17"	15"	13"
FRONT SPINDLE BEARING O.D.	7½"	5½"	4"

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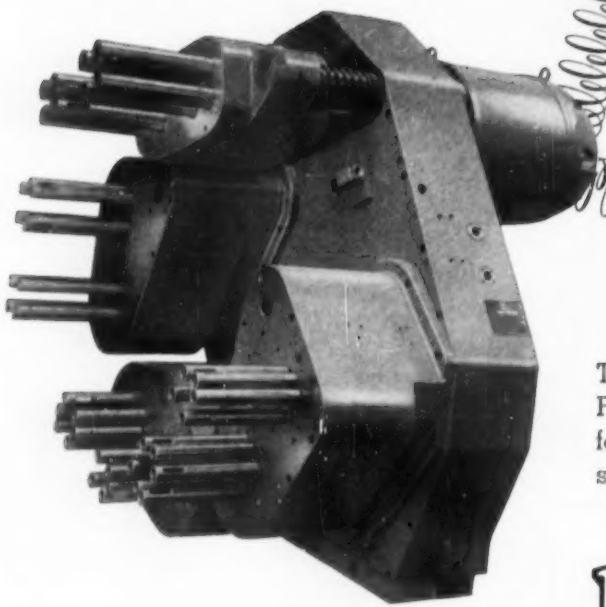

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The 50,000th Head was shipped.

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Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

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They help protect his profits

The contract shop owner prefers Producto die sets because they help protect his die performance...his delivery promises...his profits.

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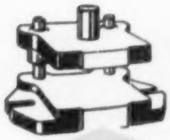

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$7200 per month saving by large automotive plant after switching to

Stuart DASCO D-20

HEAVY-DUTY SOLUBLE OIL

An actual saving of $7200 per month, including labor costs, has been reported by a large automotive transmission plant since switching to Stuart's Dasco D-20—*the first truly heavy-duty soluble oil* formulated and priced for general application!

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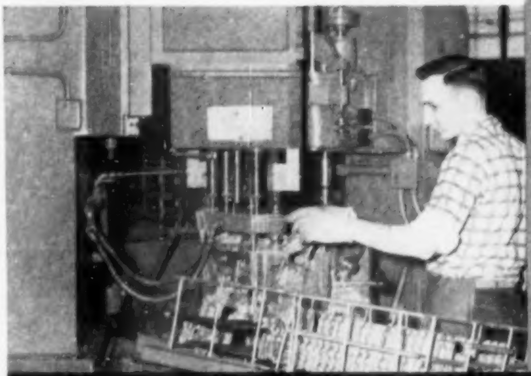
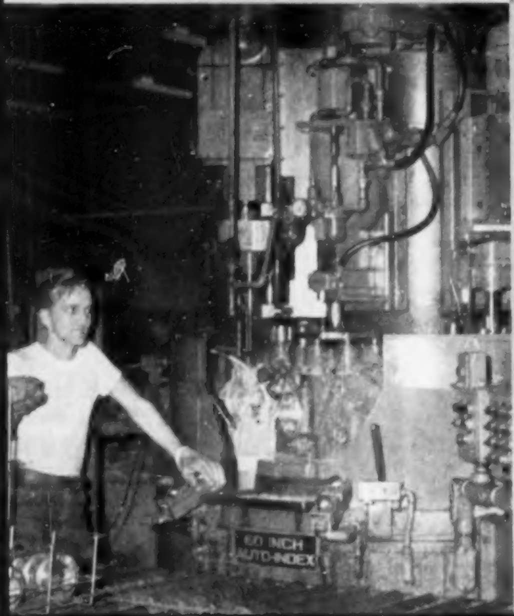


Chips settle faster with Stuart's Dasco D-20, so you have a clean compound in your machine at all times. You get a better finish . . . cooler cutting and grinding.



You can use low-priced Stuart's Dasco D-20 for reaming, boring, drilling, facing, chamfering, milling, tapping, threading, broaching, surface-grinding, and high-speed carbide tool machining.

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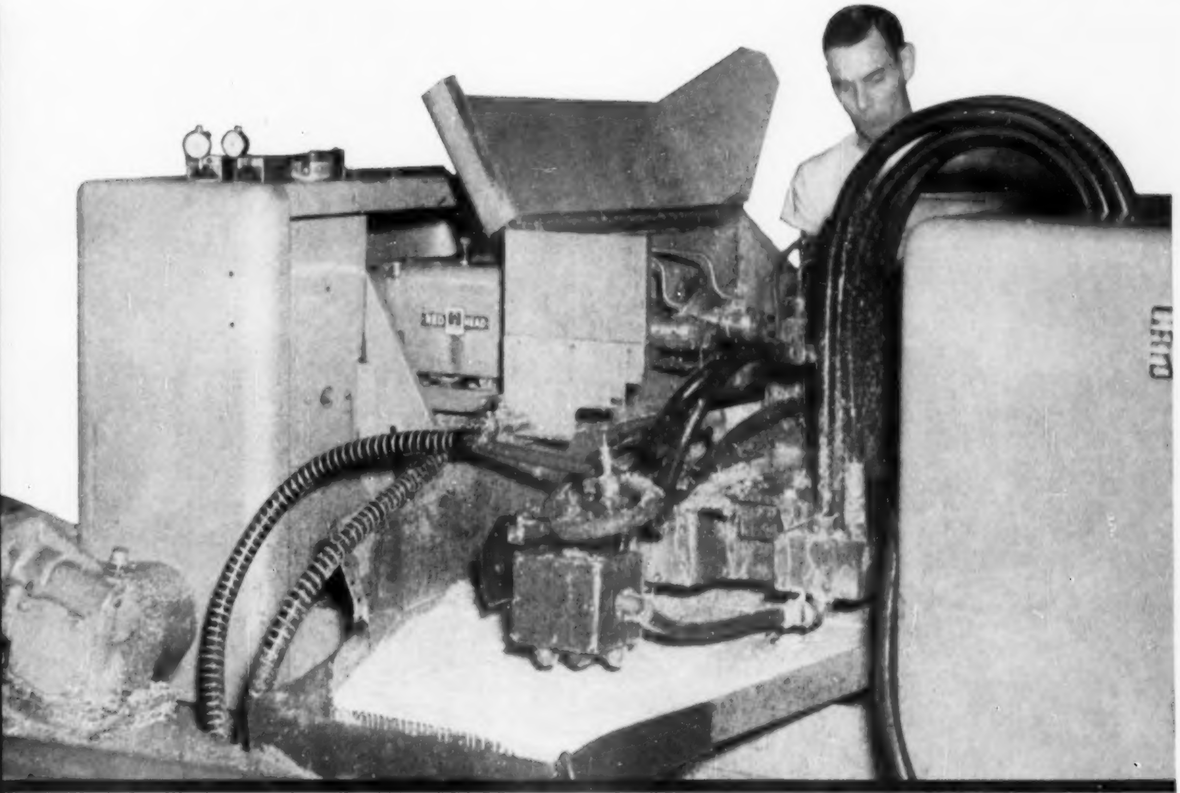
Stuart's Dasco D-20 maintains or improves efficiency of your cutting and grinding operations. A real heavy-duty emulsifiable oil, it forms a tough, thin film between the cutting tool and the work . . . reducing friction and preventing excessive heating. A wide variety of tough metal-cutting operations, including certain types of broaching, can be done with this *one* low-priced compound. A lean mixture for grinding enables you to take full advantage of improved wheel bonds. Properly applied, it allows you to use high-unit pressure for maximum stock removal . . . keeps wheels open and free-cutting . . . prevents heat checking.



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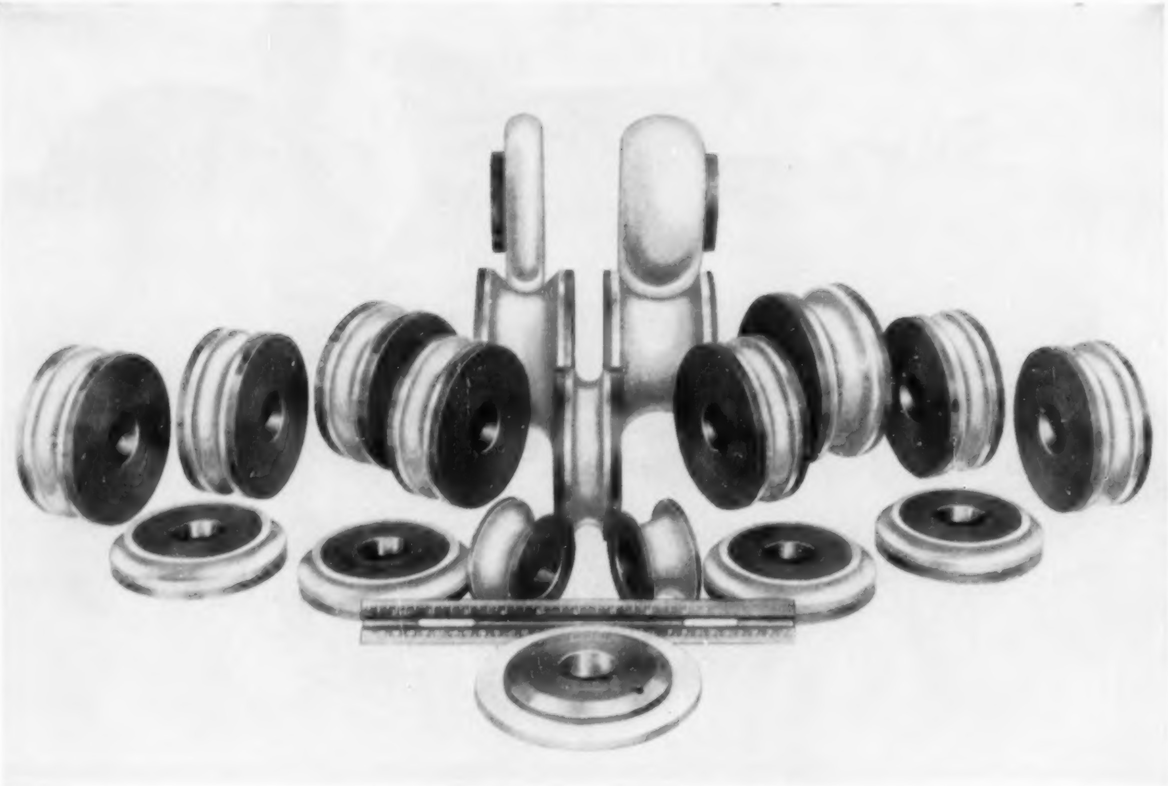

Kennametal tube-forming rolls finished by Allied Manufacturing Co., Inc.

Tube-forming rolls of KENNAMETAL* save 20 times their initial cost

- **outwear steel rolls 10 to 1**
- **improved product appearance**
- **greatly increased production**
- **less tube mill downtime**

One male roll of Kennametal was run for 345 days for the final form on a tube-forming mill. Upon removal for inspection, after producing 20,700,000 feet of tubing, the Kennametal roll was found to be in perfect condition. During that time, steel rolls in the mill were replaced every 6 to 8 weeks, with 2 to 40 days lost in downtime to replace rolls and line up the machine . . . or a loss of 60,000 feet in production per day of downtime.

The results of this test were so outstanding that all of the steel rolls on this operation were replaced by rolls of Kennametal which have been in continuous operation for over six months. With a life expectancy of at least ten to one over steel rolls, the Kennametal rolls are expected to pay for themselves within four months, with a total saving on the investment of over $450,000.

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Choose Kennametal for your tube-forming operations

Kennametal's "90 Series" with six grades and the exclusive non-galling "80 Series" with three grades provide a range of grades to meet the specific requirement of practically any tube-forming die or wear part application. Kennametal sustains high production rates, maintains accuracy over extremely long production runs with a minimum of maintenance and machine downtime—all contributing to lower unit costs.

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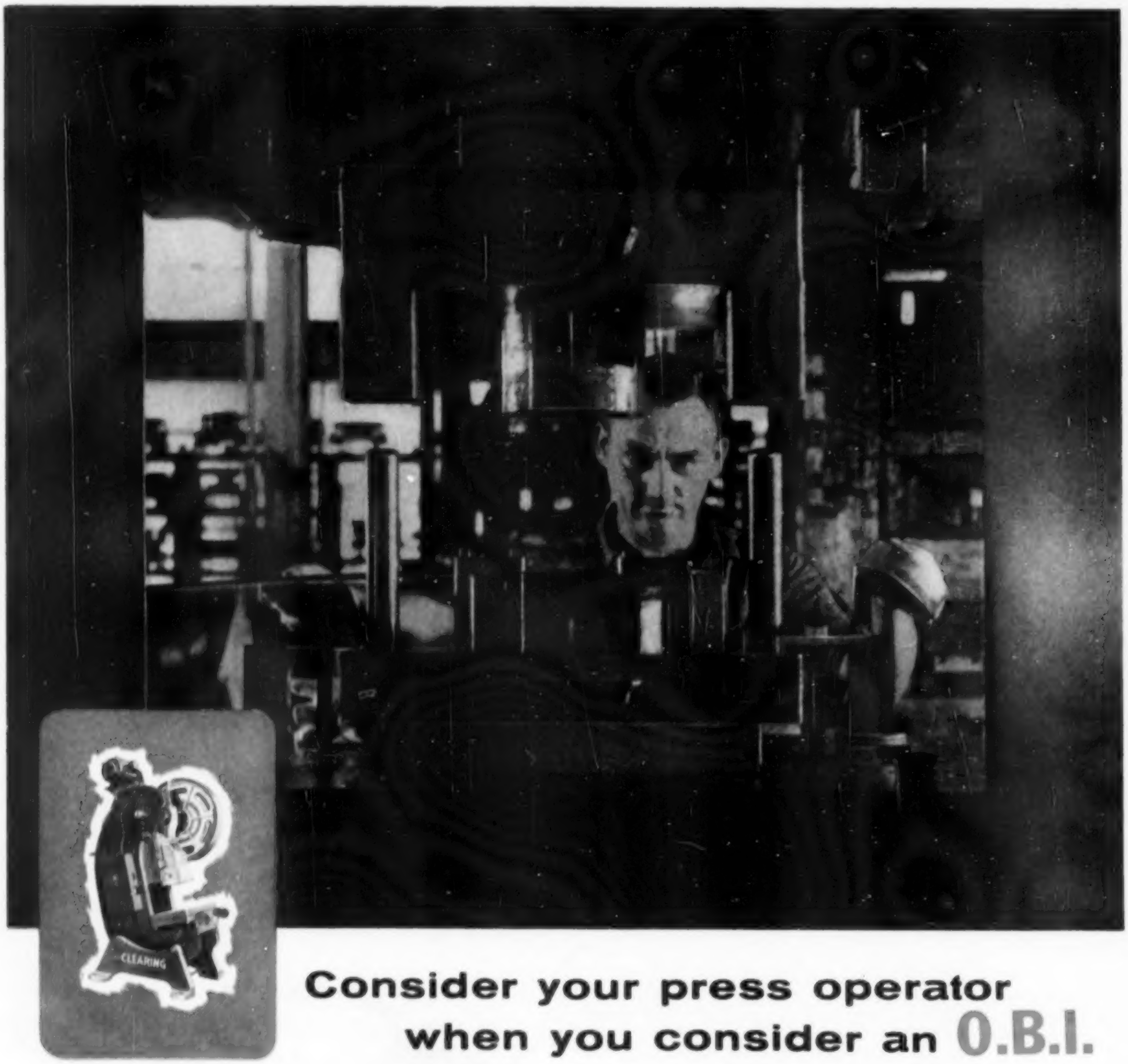


The Tool Engineer

Total Education

A person's "total education" is the sum of his formal education and experience. Although the importance of balance between these two is understood today, the need for formal education in tool engineering has not always been recognized. Consequently, the total education of a typical ASTE member is heavy in experience.

We can be proud of our experience-educated engineers. They have made possible our fabulous standard of living. Through ASTE, they have made industry and educators aware of engineering problems in manufacturing. As a result, they are being joined by many graduate engineers, and more courses, seminars and conferences are available for those in tool or manufacturing engineering.

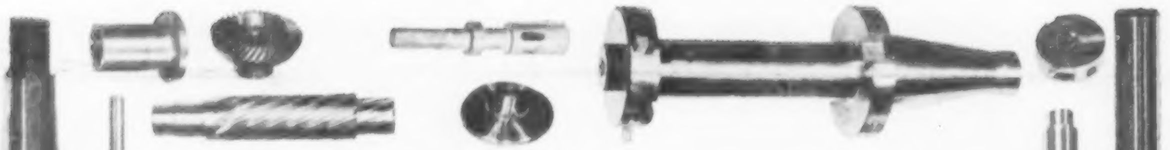
A recent survey reveals a steadily increasing percentage of degree holders in our membership. Nine engineering and ten other degree classifications are represented. This mirrors our contention that the word "tool" is used in its broadest sense when we say "tool engineer." Unfortunately, we ask for specialization when we request engineering schools to teach tool engineering. "Tool engineering" then usually means metalworking, or even more specialized parts of that activity.

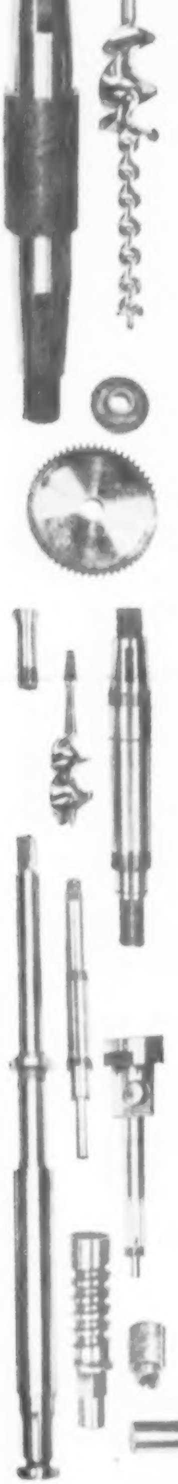
Many engineering schools are already considering elimination of the specialized curricula. They now favor stressing fundamentals of both science and engineering. We in ASTE should pause to consider whether our best interests really are in opposition to this trend.

In the best interests of our profession, we should forget about recognition per se. We have accomplished much with our total education. As formal education and experience come closer to balance, we can do even more. We should continue friendly, constructive relations with schools and, at the chapter level, we can provide additional specialized training so that our total education will continue to expand.

H. C. McMillen

PRESIDENT





If you machine parts like these...

we can save you UP TO 30%

...with Ryerson <u>leaded</u> steels

If you machine carbon or alloy steels for production or maintenance applications—you should be able to make substantial savings by switching from a standard steel to a Ryerson *leaded* steel.

We can tell you about customers who produce up to 50% more parts per machine hour, now that they have changed over to a leaded steel recommended by Ryerson. Others report tool life lengthened as much as 300% . . . rejects reduced to all-time lows . . . machine down-time slashed . . . finishing processes eliminated.

The nation's largest stocks of leaded steels in a wide range of types and sizes are ready for quick shipment from Ryerson. (See listing below.) Each is the fastest machining steel of its type available anywhere. If you are not now using leaded steels, it will be worth your while to investigate the possibility of adapting one of them, or several, to your operations.

A Ryerson representative will be glad to work with you. Show you dozens of case histories—good hard facts that document just how well Ryerson leaded steels have worked out under actual shop operating conditions. Call your nearby Ryerson plant.

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CARBON STEEL BARS

Ledloy (Screw Steel) . . . Cold drawn rounds, squares, hexagons.

Rycase (Case Hardening, Low Carbon, Manganese) . . . Cold finished rounds.

ALLOY STEEL BARS

Rycut 20 (Low Carbon, Case Hardening) . . . Hot rolled and cold finished rounds.

Rycut 40 (Medium Carbon) . . . Hot rolled and cold finished rounds, annealed to heat treated and stress relieved.

Rycut 47 (Medium Carbon) . . . Hot rolled, annealed rounds.

New Rycut 50 (Medium Carbon) . . . Hot rolled and cold finished rounds in annealed condition, hot rolled rounds heat treated and stress relieved.

Leaded 8620 . . . Rounds hot rolled, cold finished.

Leaded 4140 . . . Rounds, cold finished, annealed or heat treated and stress relieved.

Leaded 8647 . . . Rounds, hot rolled, annealed

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New E-Z-Cut Plates (Hot rolled, low carbon, manganese.)

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how to plan for low-cost production

By Clyde Mooney
President
Engineering Service Inc. of America
Detroit, Mich.

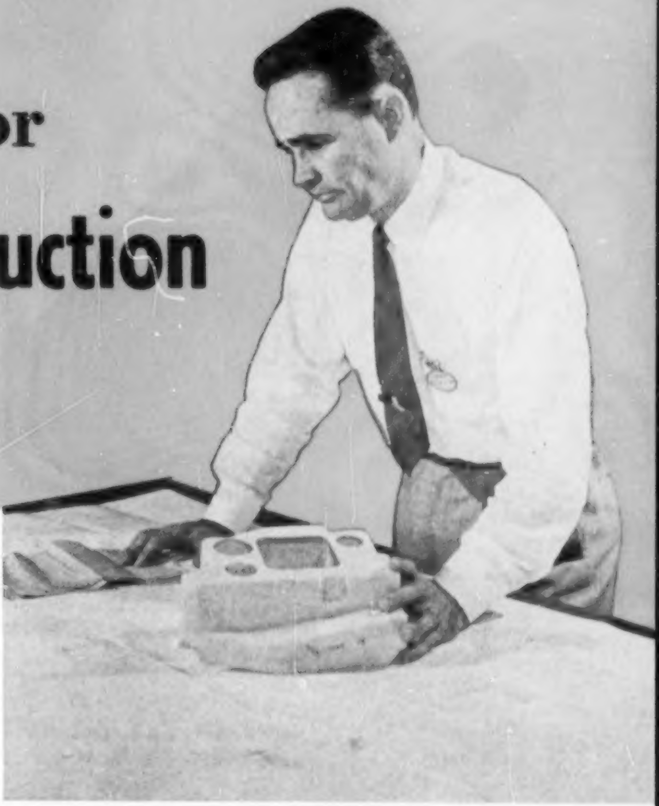


Fig. 1. Tool engineer at Northrop Aircraft studies prototype part, in this instance a glass-reinforced plastic molding, to determine if it can be produced economically.

In a highly competitive market, the key to success is the ability to reduce manufacturing cost to a minimum. As the author points out, this can be accomplished when the product design lends itself to low-cost production and when the tool engineering departments have authority to change the product design provided, of course, it does not affect appearance or function in an adverse manner.

KEEN COMPETITION lies ahead for all companies in American industry today. The ability of a company to survive in such an economy is directly related to its production of quality products at minimum cost. Minimum product costs are the result of good product design, economical tooling and sound management.

A few years back a company that had a well-tooled plant and an efficient production line had a competitive advantage. Today, thanks largely to experience gained in tooling for two wars in which a wide variety of products were made in assorted production quantities, it is uncommon to see products so poorly tooled that manufacturing costs are excessive.

What, then, is the factor that is going to provide the key to lower costs? The answer lies in the design of the product itself. It must be producible at minimum costs. No longer can the design engineer say to the tool designer: "That's the design, and that's the way it stays. Making it is your problem."

Many attempts have been made to coordinate the functions of design engineering and tool engineering in order to create a product which can be produced economically. In some plants, production engineering departments have been set up as liaison groups between design and tool engineering. In others product designs are reviewed by manufacturing departments, often at too late a date to make an intelligent study or drastic design changes that could materially cut production costs.

In many cases the authority to change a part drawing is not clear-cut. Strife between design engineering and tool engineering departments is the inevitable and unfortunate result. Greatest success is obtained when preliminary product designs are turned over to production engineering departments for review prior to development of final design drawings. The production engineering group then undertakes a detailed study to determine if the part, *Fig.* 1, can be revised to make it producible at minimum cost.

The production engineering department has full authority to change the preliminary part drawings

*Senior member ASTE Detroit chapter

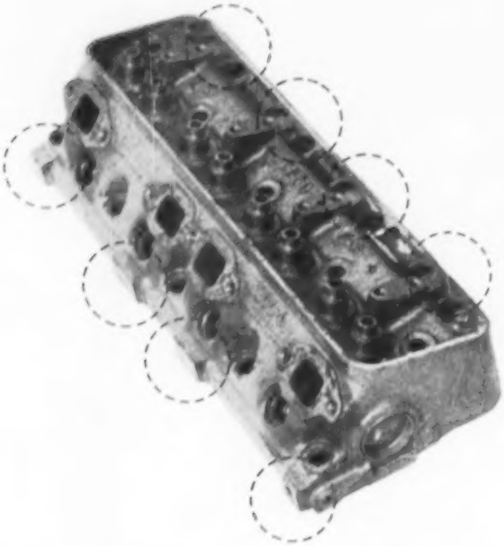


Fig. 2. Sketch of automotive cylinder head indicates bosses added for location, orientation and transfer in an automated machining line.

in any manner that does not affect the part function, it develops a manufacturing drawing of the part. A prototype is built in accordance with the manufacturing drawing and is returned to the design department for performance evaluation. If the prototype meets functional requirements, the tooling program is begun.

The Producibility Study

What changes can a production engineering department make in a part drawing to help reduce final product cost? Some possibilities will be apparent from a list of steps comprising a producibility study. First, all dimensions are reviewed, checked and evaluated with their applicable tolerances as specified on detail, subassembly and assembly drawings. This is done to assure that the components can be manufactured and assembled economically on a quantity production basis. The dimensions and tolerances are revised and implemented when necessary.

Next, all fits and their tolerances are reviewed, checked and evaluated. Fits such as slip, press and push are studied to insure economy in manufacturing and assembly on a production basis. The fits are revised or implemented as necessary.

Close tolerances raise manufacturing costs substantially. There is a tendency on the part of many design engineers to play safe and put a 0.0002-inch specification on every surface that requires a good fit. While 0.002 inch is a satisfactory fit in some applications, 0.010 inch is an excellent fit in others. Moreover, one-quarter inch is better than 0.0002 inch when only clearance is necessary. Most part tolerance studies reveal large accumulations that completely nullify close tolerances at many points.

The surface finish requirements specified on detail, subassembly and assembly drawings are reviewed, checked and evaluated to insure that the specified requirements are not unnecessarily restrictive and that they do not introduce costly manufacturing procedures in fabrication or assembly.

Too close a surface finish specification is a costly requirement that is eliminated from design drawings whenever possible. Close surface finishes require expensive equipment in the production process. So also does the finishing of surfaces that can be left in the as-cast or as-received condition.

Contour limitations on all detail, subassembly and assembly drawings are reviewed, checked and evaluated in the next step to insure that they are correctly dimensioned and toleranced. Changes are made when necessary.

After the contour check, material specifications on all detail drawings are reviewed, checked and evaluated with regard to their effect on design and production requirements. Metallurgical considerations are also included in this evaluation. All plating, painting, welding and similar specifications are checked to make certain that they are current, complete and correct, with changes made where necessary.

Detail, subassembly and assembly drawings are next reviewed, checked and evaluated to insure that gaging requirements are clearly indicated. Gaging requirements are usually listed and referenced to applicable drawings.

All lists of drawings are then reviewed, checked and evaluated to insure that they itemize all components such as drawings, standard stock items, bulk material and applicable specifications. Proper changes or additions are made.

Often design engineers neglect to provide locating holes in production part drawings. Merely adding these holes or bosses that are removed after machining can do much to simplify production problems. When a design engineer makes a part drawing he is primarily concerned with functions and appearance. Rarely does he give the manufacturing process adequate consideration. The selection of a suitable manufacturing process, however, is often the key to low production cost.

Today, with emphasis on the automatic handling of parts between machines, it is most important that part shape, handling and locating factors be adequately studied so that the part can be fed through the automatic process machines. There is an increasing trend toward continuous processing in metalworking production lines and toward mechanizing assembly operations. Success in both of these fields is strongly determined by the final design of the product, *Fig.* 2. High mechanization and minimum costs in production lines cannot be achieved without giving consideration to the requirements of auto-

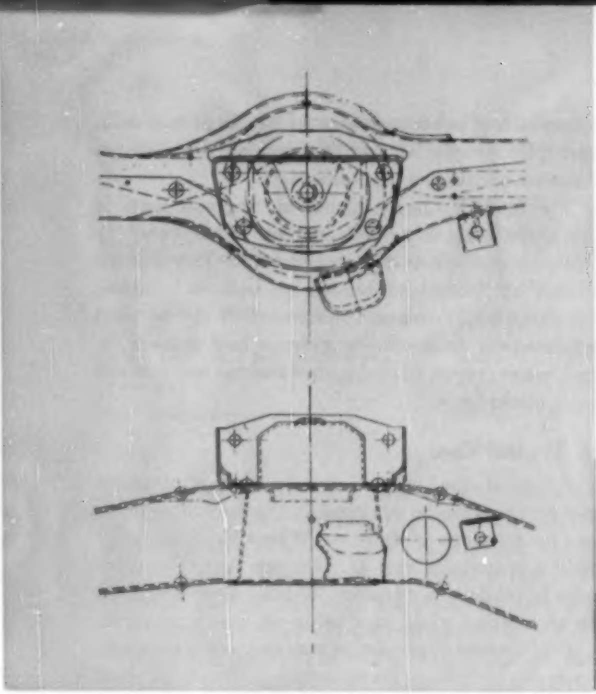
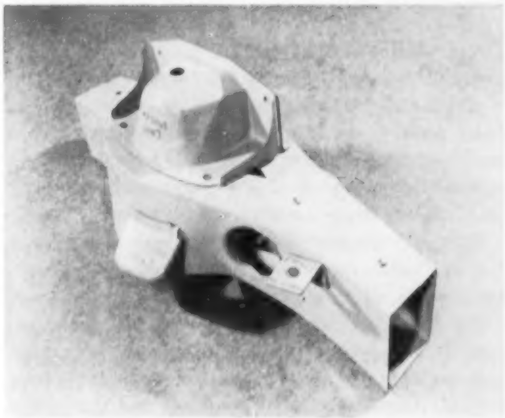


Fig. 3. Manufacturing engineering department of major automotive firm makes plastic model (right) in addition to full scale functional layout (upper left). Subassembly and major assembly models are then put together to determine feasibility of proposed manufacturing methods, fit of parts, etc.



matic processing equipment at the time the product is designed.

Finished manufacturing drawings, based on the results of the producibility studies are made up after all evaluation is completed. At this point all drawings of proprietary or commercial catalog items used on the product are reviewed to insure that essential factors such as space and weight limitations, power, current, pressures, mounting requirements, connections, performance, and operating conditions are met.

Composite, functional, large-scale layouts are also produced showing the components in functional relationship to each other. Where necessary, maximum and minimum operating positions are shown. Scale or full-size models may also be made, particularly if complex assembly problems are involved, *Fig.* 3.

This suggested method of building a production prototype of the product after the functional design has been developed may seem costly and time consuming. The cost savings that can be achieved when producible parts are evolved far offset the cost of making the production study and manufacturing drawing. It is true that more lead time from design to production may have to be allowed. However, if a product is not manufactured at minimum cost, it may never sell in a competitive market. A summary of the steps involved in redesigning for producibility is shown in the accompanying list, "Reviewing Product Designs for Producibility."

At the time the study is made, the production engineering department should be given information as to annual volume requirements, type of shift operation, equipment and space available and labor costs. This information will determine the types of manufacturing processes and equipment that will be selected. Without such information, preliminary cost studies have no real meaning.

Management must devise better means for making accurate analyses of product markets or at least give an educated guess of the range of production volume. Tool engineers today can plan production lines for nearly any type of production schedule—if they know in advance what the plans of management are and when production may have to be increased.

When a part is in production, volumes cannot be substantially increased without extremely high costs unless the possibility of expanded production has been taken into account during planning. If, on the

Reviewing Product Designs for Producibility

Review, check and evaluate:

1. **Part dimensions and applicable tolerances**
2. **Fits in relation to type (slip, push, press, etc.)**
3. **Surface finish requirements**
4. **Contour limitations on all parts**
5. **Part material specifications**
6. **Drawings for gaging information**
7. **Drawing stock lists.**

Make:

1. **Finished drawings of modified parts**
2. **Functional layout.**

other hand, a part is planned for high production volumes which never materialize, it is often impossible to amortize equipment costs. This emphasizes the need for accurate forecasting of volume requirements.

Manufacturing Cost Study

Another element in sound planning is development of a detailed manufacturing cost study, giving total direct costs per piece and the required investment in machinery, tools and equipment. The steps taken in such a study are shown in an accompanying check list, "Making Manufacturing Cost Studies."

First, a preliminary breakdown, such as shown in *Fig.* 4, of each component, subassembly and assembly is made. A master operation tool and cost sheet will include the estimated cost of machine tools, jigs, fixtures and special tools. Estimated time values for each individual operation establish operating costs, machine loads, number of machines and manpower allocation.

Next a preliminary plant layout is made to show the general arrangement of equipment and facilities, making it possible to determine floor area requirements and cost. Careful consideration is given to material and production control details so that uninterrupted production and maintenance of minimum in-process inventory are assured.

The final step in the manufacturing cost study is the preparation of a final summary which shows the complete manufacturing cost per unit. This cost includes all labor and burden as well as complete amortization of tools and equipment. With a product analyzed for producibility and cost in this much detail, management planning and tooling can proceed on a sound basis.

Making Manufacturing Cost Studies

1. **Make master operation machine, tool and cost sheets for each component**
2. **Make time studies for each operation to establish:**
   a. **Operating costs**
   b. **Machine loading**
   c. **Number of machines**
   d. **Manpower allocation**
3. **Make preliminary plant layout to determine floor area requirements**
4. **Compile a final summary giving complete manufacturing cost per unit.**

A Typical Case

A typical case history demonstrates how minimum product cost can be achieved. A representative product for purposes of study might be a valve assembly with a production rate of 7500 per year. The valve is to be made on a one-shift, 40-hour week operation in an existing plant area using all new equipment.

It is desired to present to management a complete analysis including manufacturing drawings, cost studies, process sheets, estimated times, machine load charts, plant layout and final product cost based on the planned production rate.

In the first step, the product design drawings are studied from the standpoint of producibility. Each part is examined to determine the most economical way to make it. The parts are all analyzed in detail for ease of locating, elimination of machining operation, assembly ease and sequences, and mechanized handling features.

In this case many of the parts are iron castings and a detailed study is made to determine whether the parts shall be sand cast or made by the shell process. Cost studies must be made of each part to

Fig. 4. In the aircraft industry the product is broken down into major components in early design stages and studies instituted to decide on production methods, sequences and tooling needed.

Courtesy Convair Div., General Dynamics Corp.

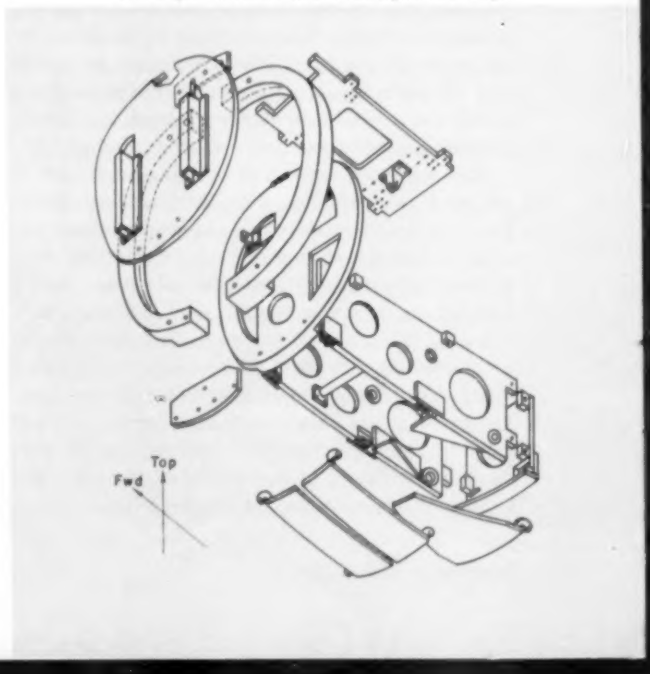


Table 1—Cost Comparison of Producing a Small Cast Part by Alternate Processes

	Sand Casting	Shell Molding
Total Machine Cost	$414,660.00	$218,020.00
Pattern Cost	3,080.00	25,700.00
Tool Fixture & Gage Cost	23,300.00	8,825.00
TOTAL	$441,040.00	$252,545.00
Direct Labor at $1.65 per hour	0.1148	0.1007
Material Cost	0.5620	0.8070
Machine Cost with 8 year amortization	0.1047	0.0545
Pattern Cost with 5 year amortization	0.0012	0.0102
Tool & Fixture Cost with 2 year amortization	0.0233	0.0088
Total Direct Cost per Piece	$0.8060	$0.9812

determine which process is the most economical for the particular part. Included in these cost studies are details such as machine cost, pattern cost, fixture and gage cost, direct labor cost, material cost; and machine, pattern and gage amortization costs that combine to produce the total cost per piece.

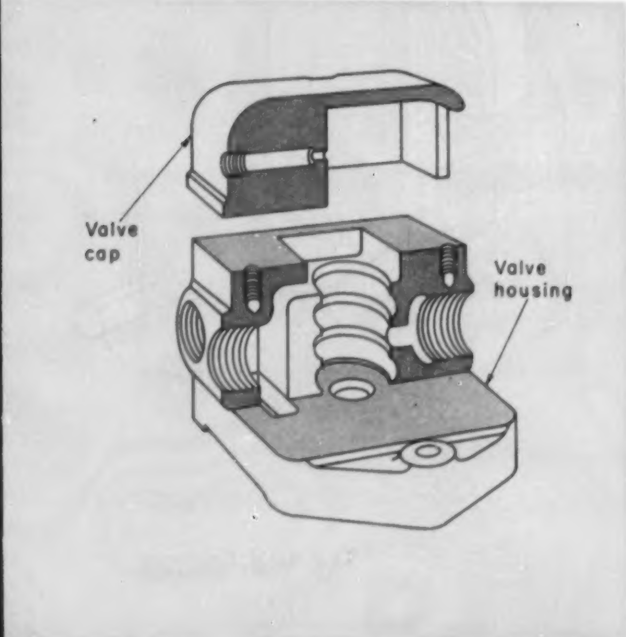
Two parts involved in this producibility and cost study are shown in *Fig.* 5. One of these is a valve cap casting and the other is the valve housing casting. The producibility study results in the following recommended changes in the design of the valve cap casting:

1. Add a construction hole for manufacturing purposes
2. Change the shape of a pad on the flat face to provide resting and clamping positions
3. Redesign one port to eliminate a milling operation in the slot face
4. Make further study to reduce over-all weight so that a shell casting may be considered, making possible further cost reduction.

The following changes were recommended in the valve housing casting:

1. Increase tolerances on height of valve seats
2. Add note specifying relationship of face of valve seat to the mounting pads
3. Revise shape of valve seats to eliminate two machining operations
4. Make a casting drawing providing for a specified amount of stock removal
5. Open up tolerances on bolt hole locations and consider use of cored holes to eliminate drilling
6. Revise casting shape to eliminate drilling of an angular hole.

Fig. 5. Valve cap and valve housing, comprising basic components of valve body.



As noted, such components can be made by either sand casting or shell casting procedures. A cost comparison between sand and shell casting for another typical part is shown in TABLE 1. In this case, study showed that the part should be made by sand casting rather than shell casting. Unless detailed cost studies of this type are made, the decision as to which process should be used is only an educated guess. Cost studies on other parts showed no set rule as to when to specify either shell or sand casting. The choice depends on design and other variables.

During producibility cost studies, tolerances are carefully evaluated and dimensional and surface finish tolerance specifications are increased wherever possible. With a satisfactory part, it is possible to proceed with the manufacturing cost study. This is based on final operation sheets, time study sheets, machine, fixture and gage costs, product tolerance layouts, machine load charts and a plant layout.

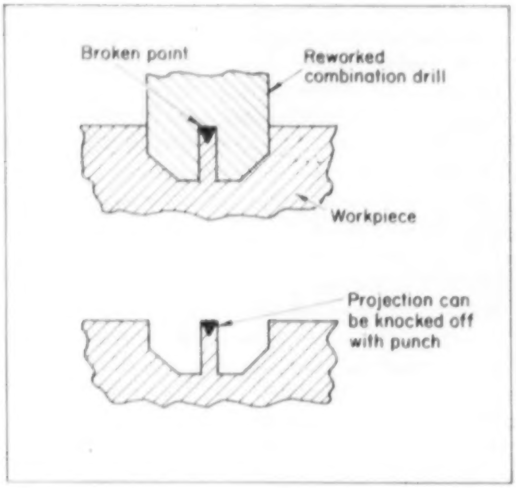
With a summary including all of this information, management can proceed with a reasonable assurance that the product will be produced at minimum cost.

The presentation of these facts to management is another key consideration that production engineers often overlook. All too often management makes a poor decision because the facts have been poorly presented. A production engineering group should devote much time to the preparation of a good report. When the report is completed, it should be delivered in person by the individual responsible for the study. It is also strongly recommended that production management be brought into the picture during the producibility planning program to keep it informed of progress. This simplifies the presentation of the final report.

After the report is accepted, the part design recommendations should be referred back to the design engineering department. If necessary, a prototype can be built so that product performance and quality can be evaluated. This permits the design department to exercise proper control over the functional and appearance characteristics of the product.

Economical production of a modern product is the result of sound planning. It takes much time and study to achieve minimum product cost without sacrificing quality. The time is well spent, however, because producibility and manufacturing cost studies offer the best means for survival of a company under conditions of keen competition.

Removing Broken Drill Points



Removing a broken drill point from a workpiece is often a difficult operation. The tool illustrated makes it possible to remove such points quickly and also spots the center of the hole when drilling operations are resumed after removing the broken point. An old combination drill is used in making the tool. The point is first ground off and then a groove is ground in the center of the drill.

To remove a broken drill point, the tool is centered over the point and the metal surrounding the point is drilled out. This leaves a projection containing the broken point. The projection can be broken off with a punch, leaving the hole clear for further drilling.

Alfred Du Paul
New Haven Chapter

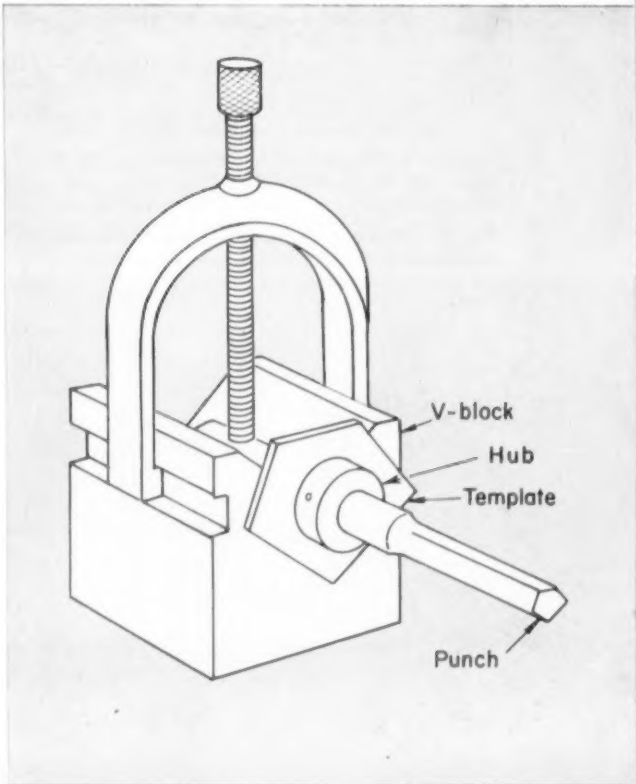
Punch Grinding Template

When grinding faces of punches like the five-faced punch shown in the drawing, obtaining the correct angle between faces is time consuming. The usual practice is to employ a dividing head, which requires considerable calculation.

The template device illustrated eliminates these problems. The device consists of a disk of appropriate size, fastened to a hub. Each hub is tapped for two setscrews. When it is desired to make a punch of the type shown, the required number of flats are cut in the disk. The angle between the flats is made equal to the angle between the faces on the punches. These templates are easy to make because there are no critical dimensions to hold, only angles.

To use the template, the workpiece is set up as shown and is rotated until the top edge of the template is parallel with the base of the V-block. One face is ground and the process is repeated until all faces are ground. The actual size of the punch is determined by measurement across the faces. Templates simplify the job of grinding faces at the desired angles. They are especially valuable when a number of identical punches are ground.

Clint McLaughlin
New York City, N. Y.



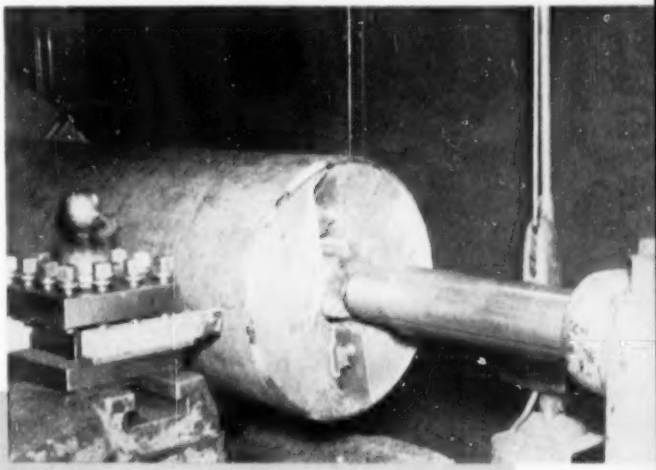
Centering Plug for Beveling Pipe

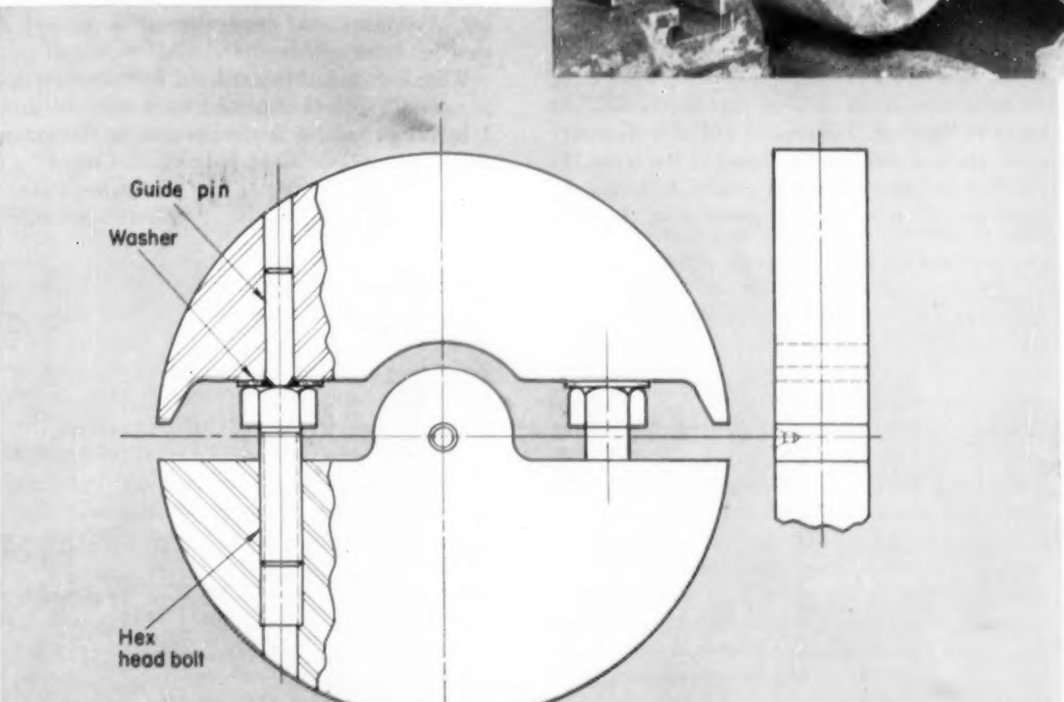
Fabricated steel and alloy pipes are produced to mill tolerances that allow for one percent out-of-roundness on the diameter. This out-of-roundness makes it difficult to machine uniform bevels on large pipe. Turning a 37½-deg welding bevel on pipe with an ID of 12¼ inches and a wall thickness of ¼ inch, is a typical job where out-of-roundness causes trouble.

A plug fixture designed to expand and center the pipe section so as to eliminate out-of-roundness is shown in the accompanying drawing. The plug body is made of hot rolled steel plate, two inches thick, which is torch-cut to approximate size and shape. The blank is center-drilled on one side and is turned to the required diameter, concentric with the center-drilled hole. It is then cut into two parts as indicated on the drawing. The lower part is drilled and tapped to receive two bolts used to expand the fixture. A guide pin is welded to each bolt. These guide pins fit into holes drilled in the upper plug section.

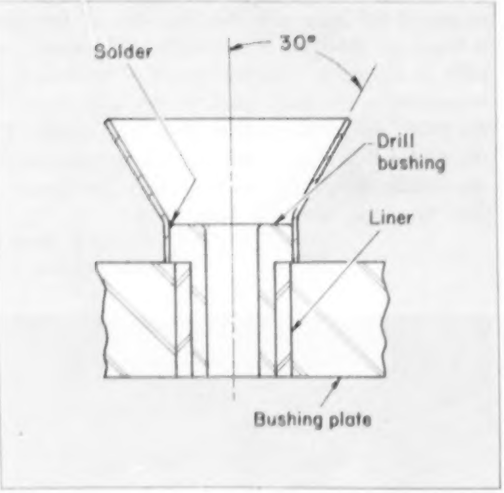
In operation, the plug is placed in the end of the pipe section to be beveled and is expanded by means of the bolts until the diameter of the pipe is trued up. Beveling is accomplished in an engine lathe as shown in the photograph. The fixture is supported by the dead center in the tailstock while the other end of the pipe is held in a chuck. By the use of this type of tooling, true bevels can be successfuly machined, working to a tolerance of plus $\frac{1}{32}$ inch, minus 0 inch.

Clement F. Brown
Willow Grove, Pa.





Gadgets



Funnel for Directing Coolant Flow

When drilling or reaming highly accurate holes that require a good finish, it is often difficult to get a concentrated flow of coolant directly on the work. Consequently, it may be necessary to reduce the rate of feed, thus slowing down the operation.

Coolant can be concentrated on the work by using the simple funnel illustrated. The funnel is formed from 14-gage sheet metal. It is attached to a drill bushing with a few drops of solder. The funnel acts as a reservoir so that there is a constant flow of coolant on the work, making it possible to drill or ream at normal feeds and speeds.

Roger Isetts
Racine Chapter

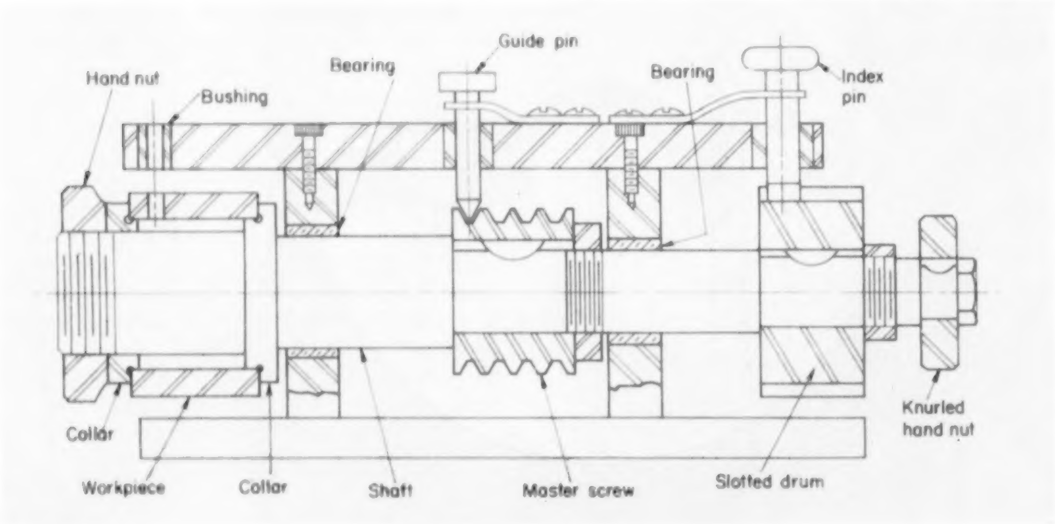
Spacing Holes on a Helix

Occasionally it is necessary to drill correctly spaced holes in a helical path around a steel sleeve or similar workpiece. Use of the jig illustrated facilitates this operation.

The workpiece is mounted between two shoulder collars on a stepped shaft supported by bearings in the jig structure and is held in place by a hand nut. A master screw, threaded to the correct helix, is keyed to the shaft. The conical end of a stationary guide pin is seated into the thread of the screw. As the shaft is rotated, it moves axially, following the guide pin. Slots in a drum mounted on the shaft have the same spacing as the holes to be drilled in the workpiece. An indent pin seats into the slots in the drum to hold the workpiece in position for drilling, and can be lifted out of the slot for indexing. A knurled hand nut at the end of the shaft is used for indexing.

When the shaft is indexed, the workpiece surface is rotated in a helical pattern relative to the drill. A hardened bushing in the top plate of the fixture guides the drill.

H. J. Gerber
Stillwater, Okla.
Member-at-Large



How to Decide . . .

four-slide press or progressive die?

By J. H. van der Burgt
N. V. Philips' Gloeilampenfabrieken
Eindhoven, Netherlands

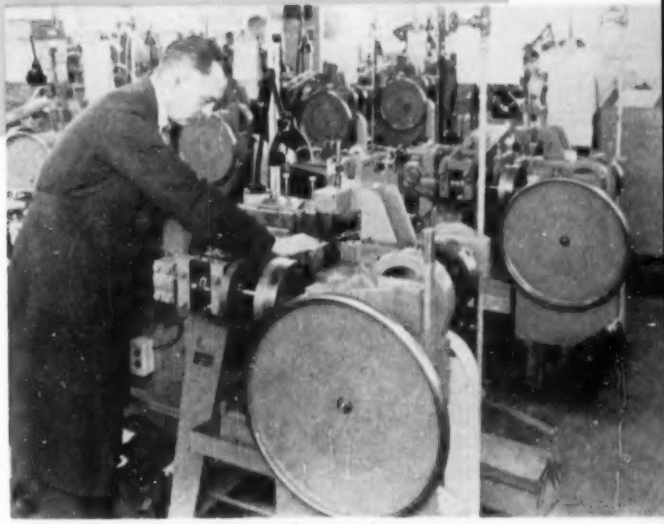


Fig. 1. Typical four-slide production department.

Can small stampings be produced more economically by four-slide methods or on a progressive die? The author, who has 37 years of experience with both types of tooling, lists the factors which must be considered before making a choice between the two methods and gives several examples of parts which have been tooled both ways.

FOUR-SLIDE PRESSES are often classed as special machines, best suited for wire forming operations, or for profiling, shaping, lock-seaming and stitching parts. However, such presses can be successfully used in the manufacture of many types of small stampings which are traditionally made on progressive dies. Often parts produced on a four-slide press, *Fig.* 1, are of higher quality than comparable parts produced on a progressive die and manufacturing costs may be significantly lower.

Principles of Four-Slide Operation: While four-slide presses appear to be complex, their principle of operation is relatively simple. Stock is automatically fed from a coil through a die set, *Fig.* 2, where it is pierced, profiled, embossed or formed. Emerging from the die, the strip is fed in front of a mandrel, pushed against the mandrel by means of a spring pad, cut off and finished by tools mounted on the slides. A stripper then descends and pushes the part off the mandrel.

All slides are cam-operated and the cams can be changed as dictated by the requirements for manufacturing a specific product. The stripper head, *Fig.* 3, is fastened to the frame of the machine and operation of the stripper is synchronized with the operations of the slides.

Many variations are possible with this method of forming. It is possible, for instance, to position the mandrel either vertically or horizontally or at any desired angle. It is even possible to dispense with the mandrel entirely by using a stationary tool on one of the slides as a fixed forming element. Hourly production can be doubled in some cases by manufacturing two parts simultaneously from one strip of material. Complex parts can be partially formed at the level where they enter the die. They are then transported by the stripper to a lower

level on the mandrel where a second set of tools completes the forming operations. In some cases, a third level, and third set of tools, may also be employed. This flexibility greatly extends the capability of four-slide production methods.

Cost and Quality Considerations: There are several considerations which govern the choice of four-slide or progressive die production methods for specific parts. The most important of these are:

1. Design of the product
2. Material cost
3. Frequency and cost of maintenance
4. Labor cost
5. Product quality
6. Initial tool cost.

All of these factors should be carefully weighed before making a decision to tool for production by either method.

PRODUCT DESIGN: The shape and dimensions of a part may dictate the selection of one production method or the other. Because of the short stroke of four-slide presses, they are not suited to the manufacture of parts requiring deep draws. If, on the other hand, deep draws are not required and the metal must be bent in several different planes, four-slide production methods can be used to advantage.

MATERIAL COST: Both production methods utilize coil stock, which is automatically fed into a die. As a general rule, less material is required to produce a part on a four-slide press than would be

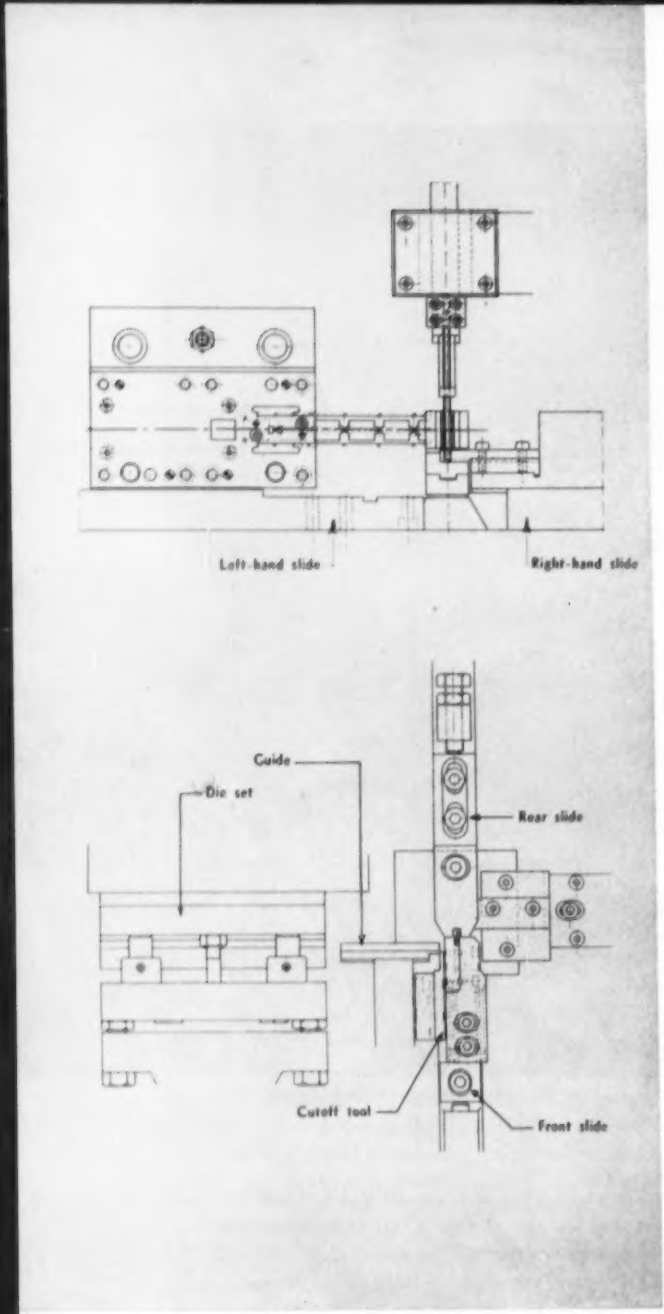


Fig. 2. (above) Four-slide tooling in a press.

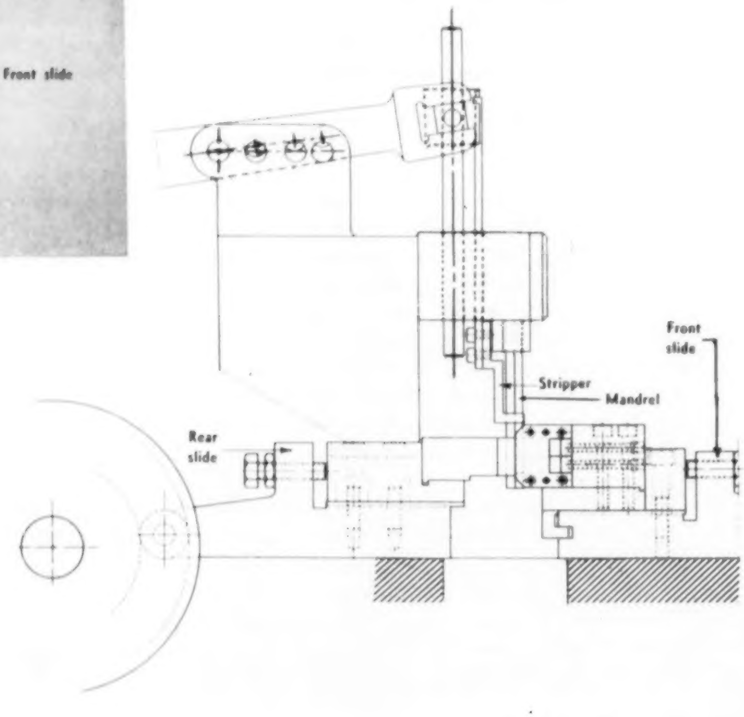


Fig. 3. (right) Stripper mechanism pushes finished parts off mandrel.

required to produce the same part on a progressive die. The operating characteristics of progressive dies make it necessary to use extra material. On many progressive dies, for instance, pilots must be used to insure accurate feeding. Extra stock must be provided for pilot holes. Even when pilots are not used, it is often desirable to allow extra stock width to prevent buckling of the material strip. It is difficult to control feed length precisely in progressive dies. To compensate for possible irregular feed lengths, extra material is usually left between successive blanking positions in the strip, increasing material costs.

Material requirements can be held to a minimum when parts are made by four-slide operations. Modern four-slide presses have accurate adjustable feeding mechanisms which eliminate the need for pilots and, since the length of feed is constant, feed length is usually made equivalent to blank length. Often the width of the stock can be made the same as the required height of the blank, reducing scrap losses to a minimum.

MAINTENANCE: Reliability of four-slide dies—the degree of trouble-free operation—tends to be somewhat better than that obtained with progressive dies. Many progressive die troubles can be traced to buckling of the strip, which is difficult to control when bending thin material. The bends made on progressive dies are limited to those which can be produced by the straight up-and-down motion of the press ram, unless auxiliary cam-operated bending mechanisms are used. These mechanisms add to the complexity of the die and constitute a potential source of breakdowns. When they are used, it is not possible to adjust the stroke of the bending tool. Accordingly, dimensions of punches, cams and related equipment are critical and exceptional care must be used in die repair and sharpening.

Buckling of the strip is not a major problem in four-slide operation, owing to the fact that the material strip is usually profiled, rather than cut out. Moreover, material can be bent in any desired direction with normal four-slide tooling, eliminating the need for special cam-operated tools.

Generally speaking, four-slide tools can be made stronger than the components of a progressive die. The necessity for fitting all components of a progressive die into a small space limits their size. They cannot be designed for optimum strength. Accordingly, die breakage is more frequent with progressive dies than with four-slide tooling.

LABOR COSTS: Labor costs for stamping operations depend, in the main, on the degree of automation applied and the frequency of die changes.

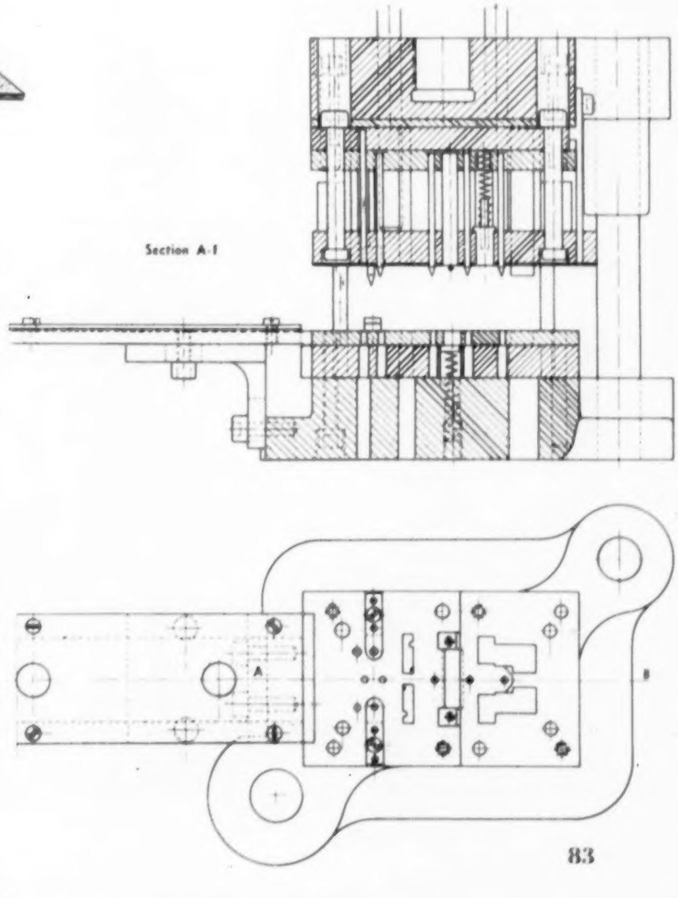


Fig. 4. (above) Small stamping first produced on a progressive die, later produced by four-slide methods.

Fig. 5. (right) Ten-station progressive die used to produce part shown in *Fig. 4*.

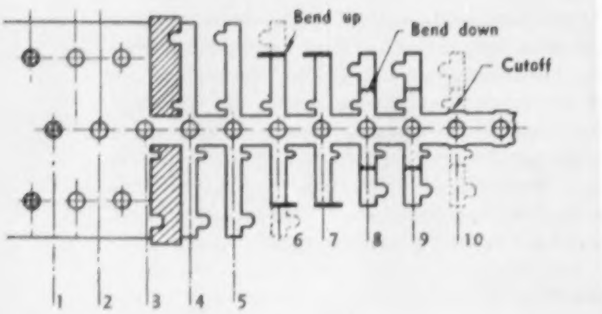


Fig. 6. Successive operations performed on strip of material by ten-station progressive die.

The automatic and relatively trouble-free operation of four-slide presses makes it possible for one man to operate three or four presses. Limit switches are normally used to stop the presses when the coil of stock is exhausted or when there is a malfunction in feeding. This ability to operate with a minimum of operator attention often makes direct labor costs lower for four-slide operations than for progressive dies.

Die-setting time can be an important factor in labor costs, particularly when production runs are short. This time is made up of three factors: changing tools, adjusting feed and adjusting press stroke. The time required for changing coils of stock and for adjustments as the production run is started must be added to die-setting time to obtain a complete estimate of the cost of changing over from one product to another.

A total of 125 minutes is required to change progressive dies: 55 minutes for actually changing the tools, 40 minutes for adjustment in operation and 30 minutes to change coils. Changing four-slide tooling requires 90 minutes to change the dies, 30 minutes for adjustments during operation and 30 minutes to change stock, for a total of 150 minutes.

The faster times obtained with progressive dies are possible because a progressive die is a single compact unit, requiring only a few adjustments. Changing four-slide tooling involves adjusting the die, the cutoff mechanism, the tooling on the slides, the mandrel and the stripper.

QUALITY: Quality of parts manufactured on four-slide presses generally is better than that obtained from progressive dies. The cross-adjustment feature on four-slide presses makes it possible to adjust the tools on the slides in any direction. The tools of a progressive die, on the other hand, cannot be cross-adjusted. Despite the accuracy obtainable

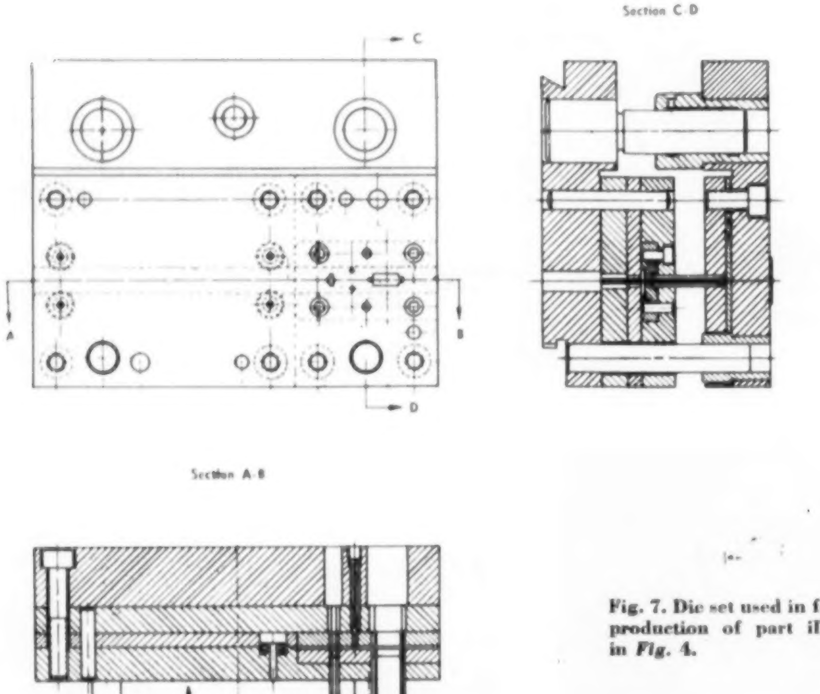


Fig. 7. Die set used in four-slide production of part illustrated in *Fig.* 4.

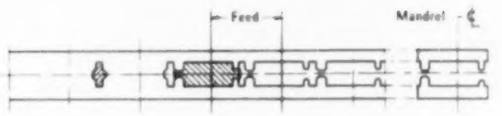


Fig. 8. Piercing operation performed in four-slide die produces two profiled strips.

with modern toolmaking equipment and practices, small deviations from design specifications are always possible. These deviations can be compensated for in a four-slide press, but cannot be readily corrected in a progressive die.

As has already been pointed out, buckling of the material strip can be a serious problem with progressive dies. Even when it does not cause press stoppages it may cause distortions which affect the quality of the finished product. Buckling and distortion are lesser problems in four-slide operations because bending operations are accomplished after blanks have been cut off from the strip.

INITIAL TOOL COST: Last, but not least, of the factors governing the selection of four-slide press or progressive die methods is the initial cost of the tooling. Generally, the initial cost of tooling for four-slide production is higher than the cost of a progressive die for the same product. This cost, however, is offset by longer tool life, making the tool cost per part lower if the number of parts required is sufficiently large.

Examples of Parts Tooled Both Ways: The advantages of four-slide methods were illustrated when a number of small parts, originally produced on progressive dies, were later manufactured on four-slide presses. A typical part, *Fig.* 4, was originally manufactured on a ten-station progressive die, *Fig.* 5. The successive operations are illustrated in *Fig.* 6. They are:

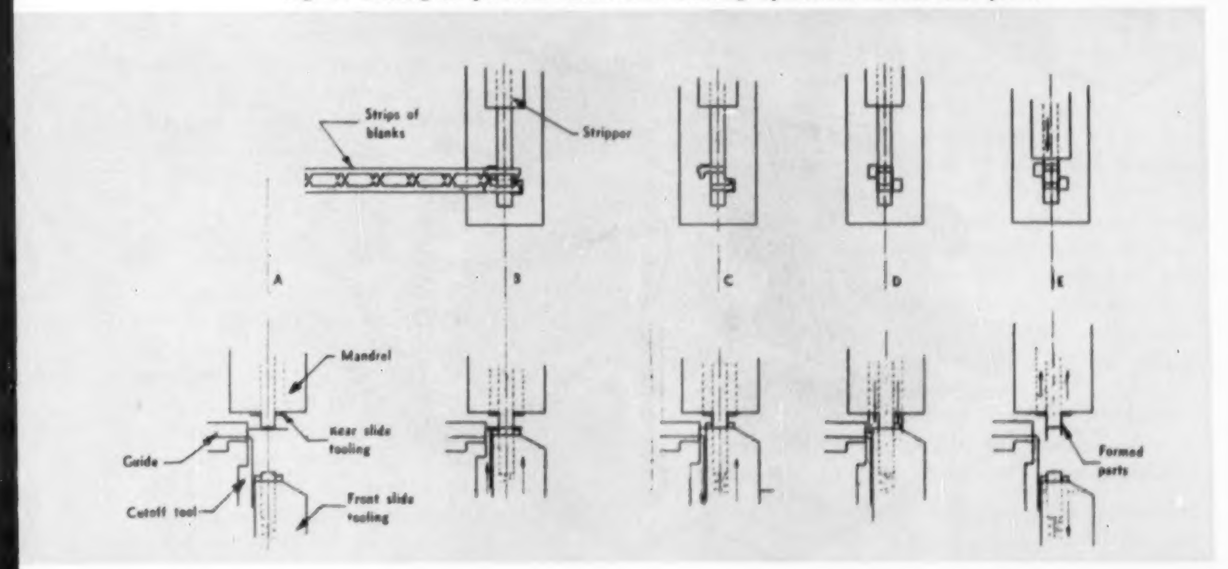
Station 1—Pierce three pilot holes
Station 2—Correct feed length by means of pilots
Station 3—Idle
Station 4—Pierce two holes
Station 5—Pilot
Station 6—Bend up outer sides of blank
Station 7—Pilot
Station 8—Bend wing ends down
Station 9—Pilot
Station 10—Cutoff.

Since it was necessary to bend the strip of material in two different planes after profiling, the strip tended to catch in the die prior to cut-off. This difficulty was avoided when four-slide tooling, *Fig.* 7, was adopted for the same part, because all bending is done with the blanks in a stationary position on the mandrel.

As can be seen from the layout of the material strip, *Fig.* 8, two holes are pierced in the strip, profiling two parts simultaneously and cutting the stock lengthwise. The resulting two rows of blanks lie perfectly flat and straight in the die so there are no distortions which could affect part quality.

Following piercing, the necessary cutoff and bending operations are accomplished by tooling on the front and rear slides of the press, *Fig.* 9. The two rows of blanks are transported in front of the mandrel as shown at "A." At "B," the front slide moves in and presses the strips against the mandrel, after which both blanks are cut off. The front slide then moves further in and bends back

Fig. 9. Tooling to perform cutoff and bending operations in four-slide press.



the right side of the upper blank and the left side of the lower blank, as shown in "C."

The tool mounted on the rear slide passes through two holes in the mandrel and bends the left side of the upper blank and the right side of the lower blank against the tool on the front slide at "D." This completes the parts, which are stripped from the mandrel as shown at "E." The stripper then moves up, the feed mechanism moves the strip into position and the bending operations are repeated on the next set of blanks.

Savings through Four-Slide Operation: Substantial savings were made possible by the change to four-slide production methods. These savings were due to reduced material and labor costs, greater reliability of the four-slide tooling employed and longer tool life.

Material requirements for the part were reduced by 44 percent as a result of the change-over to four-slide production. At the same time labor costs were reduced by nearly 13 percent since one operator could tend more machines. While the tooling for the four-slide operation cost 50 percent more than the progressive die, the life of the progressive die was approximately one million pieces, as compared to two million pieces for the four-slide tooling. Thus tool costs per part were 25 percent less when parts were manufactured on a four-slide press.

Comparable savings, plus improved product quality, were obtained by using four-slide tooling to manufacture several other parts formerly produced on progressive dies, *Fig.* 10. In the case of the part shown on the left, material costs were reduced nearly 17 percent, labor costs were reduced 53 percent, and tool costs per part were reduced 47 percent. Four-slide production of the part on the right resulted in a 27 percent saving in material costs; a 51 percent saving in labor costs and a 34 percent saving in tool cost per part.

Such savings indicate that when planning the manufacture of small stampings, the possibilities of four-slide tooling should not be overlooked. An added benefit, in many cases, is the better quality of parts manufactured by four-slide methods.

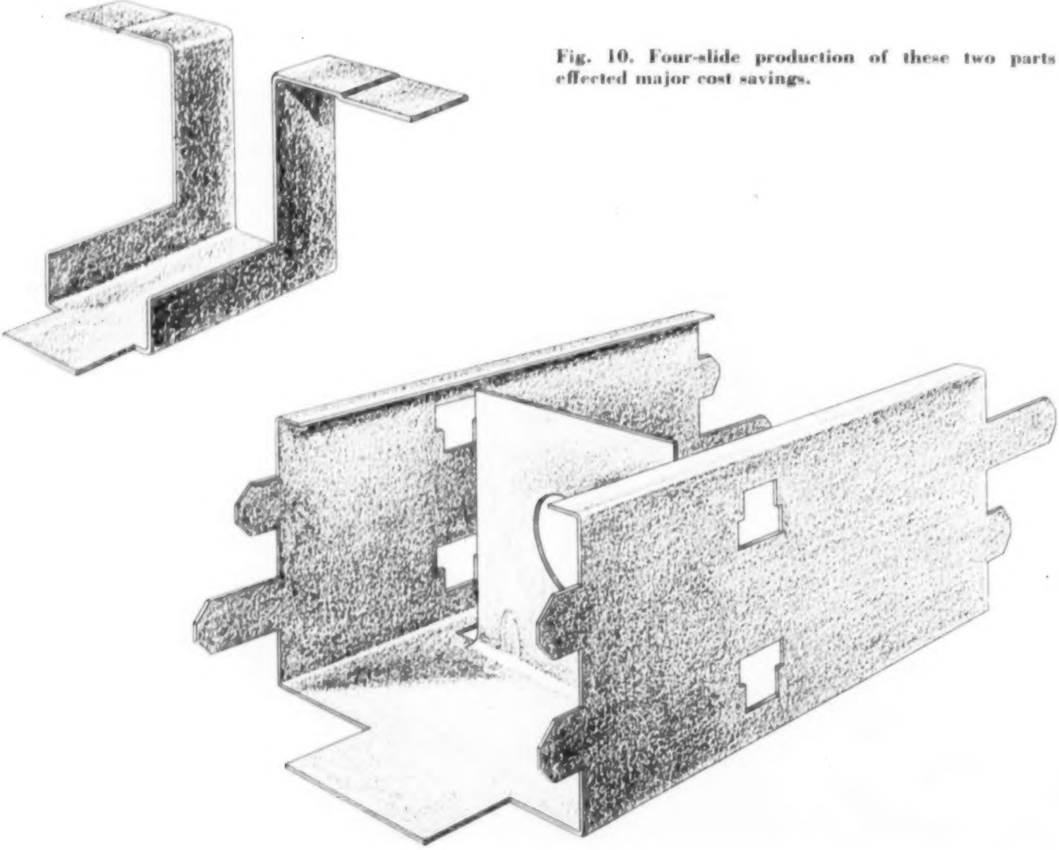


Fig. 10. Four-slide production of these two parts effected major cost savings.

how to predict

machine capability

...for precision control of quality

By William H. Nahm
Quality Control Engineer
Brush Electronics Co.
Cleveland, Ohio

What tolerance limits can be held in a given machine? Only tests under carefully controlled conditions can provide the answer. Once the capability of a machine is known, quality control checks during the production run make it possible to forestall or correct conditions which may result in unsatisfactory machine performance.

MACHINE CAPABILITY, from a quality control standpoint, is the ability to consistently produce dimensionally accurate workpieces when machining the same materials under the same conditions. Accurate knowledge of the capabilities of individual machines in a shop is essential if product quality is to be high and manufacturing costs kept at reasonable levels. When specified part tolerances cannot be held on a given machine, excessive rejection rates may result. If, on the other hand, a machine is capable of high precision work, it is wasteful to use it for jobs where close dimensional tolerances are not specified.

For economical manufacture, it is necessary to make sure that the capability of a machine matches the tolerances specified for a part. At Brush Electronics Company, this is accomplished as part of a planned quality control program, in which machines are tested under the same conditions which are encountered in production, *Fig.* 1.

The resulting capability data are used in establishing a standard of performance for the machine, part and setup tested. During subsequent production runs, work samples are taken at frequent intervals to see if the machine is performing according to its predicted capability. Deviations from the predicted performance indicate the need for adjustment of tooling or machine maintenance.

Establishing Machine Capability: Machine capability is established on the basis of at least 50 samples taken during a test run. These samples are taken in groups of five consecutive pieces. Part dimensions which must be controlled are measured and recorded on a work sheet, *Fig.* 2. A separate work sheet is used for each dimension. As shown in column 1 of the work sheet illustrated, the average of each group of five consecutive readings (X) is recorded, along with the largest and smallest readings and their difference (R). At least ten sets of readings and calculations are made in this way.

Dial gages are preferred for taking the measurements, so as to reduce the possibility of error in taking readings. The gaging equipment used must be capable of indicating to at least one decimal place beyond the drawing specification for the part, and all gages are checked frequently to insure accuracy. Only skilled inspectors are employed to take measurements and record data, and they are discouraged from rounding off the readings.

When all sample readings have been taken, average sizes ($\bar{X}$) and ranges (R) are recorded in columns at the right of the work sheet and grand averages ($\bar{X}$) and ($\bar{R}$) are noted in the appropriate boxes. There is now enough data to establish con-

BRUSH ELECTRONICS COMPANY
DIMENSIONAL QUALITY CONTROL
WORK SHEET
AVERAGES AND RANGES

Fig. 1. Precise knowledge of machine capability is essential to hold down rejection rates and maintain high quality standards. It is especially important when tests, such as the one shown for machinability, are conducted.

trol limits within which 99.7 percent of the product of the machine will fall when machining the same materials under the same conditions. These limits are obtained by applying the formulas:

$$\text{Upper control limit for size} = \overline{\overline{X}} + A_2\,\overline{R}$$

$$\text{Lower control limit for size} = \overline{\overline{X}} - A_2\,\overline{R}$$

A_2 for samples of five is 0.577.

Range limits are set by the formulas:

$$\text{Upper control limit for range} = D_4\,\overline{R}$$

$$\text{Lower control limit for range} = D_3\,\overline{R}$$

D_4 is 2.114 and D_3 is 0 for samples of five.

The values of A_2, D_3 and D_4 are obtained from the "Quality Control Handbook," Table F, in Appendix II by Juran, published by McGraw-Hill. The factors are based on the size of the sample and adjust for the probability that the average from lot to lot will fall within the predicted range. Of course, as the sample size becomes larger, the probability factor becomes smaller. The numbers chosen were based on a sample of five units, as a matter of convenience and economical accuracy.

Size and range limits are indicated at the bottom of the work sheet. These are the guides which are necessary to establish and maintain machine performance. The machine should not be used for parts which have tolerances which fall inside of the control limits. Ideally, specified part tolerances should fall just outside of the control limits, and if the tolerances fall much more than one-sixth of the control range beyond the control limits, selection of a more economical process is indicated.

Copies of the work sheets are filed for reference, providing a guide to product design engineers in specifying tolerances and aiding tool engineers in selecting machines for similar jobs in the future.

Controlling Machine Performance: Machine performance variations fall into two basic classifications: piece-to-piece fluctuations such as those caused by differences in the material being machined, and consistent drifts of average piece-to-piece dimensions due to machine and tool wear. In order to obtain a clear picture of piece-to-piece variations and the direction of trends, the $\overline{X}$ averages and R ranges are plotted on a quality control chart, *Fig.* 3. This chart is posted at the machine in order to provide current information as to the condition and trend of the machine and product.

Convenient, easily measured increments of size and range are written into the space provided in the left-hand column. The $\overline{X}$ averages and R ranges, taken from the work sheet, are plotted in the proper place. Control limits and part tolerances are shown by heavy lines drawn across the chart. When information from samples is plotted on the chart, out-of-control trends are readily noted and the direction of required changes is obvious.

No further inspection is required of parts which have been produced before satisfactory samples. However, each group of parts produced between samplings should be segregated until the sampling indicates that they are satisfactory.

The technique described is a modern method of measuring machine performance. It is successfully used for predicting machine performance, for controlling processes, for evaluating products, for testing equipment and for studying tolerance problems.

Fig. 2. (right) Work sheet used to record data and calculations necessary to predict machine capability.

BRUSH ELECTRONICS COMPANY
DIMENSIONAL QUALITY CONTROL

WORK SHEET

AVERAGES AND RANGES

PART NUMBER 127790	DESCRIPTION PLUNGER -O.D.		
LOT NUMBER 12	ORDER NO E-179	MACHINE NO TL 3	DEPT 320
OPERATOR KOVAKS	SHIFT 1	DATE 2-12-56	INSPECTOR WILSON

DIMENSION AND TOLERANCES: .6875 ± .0005

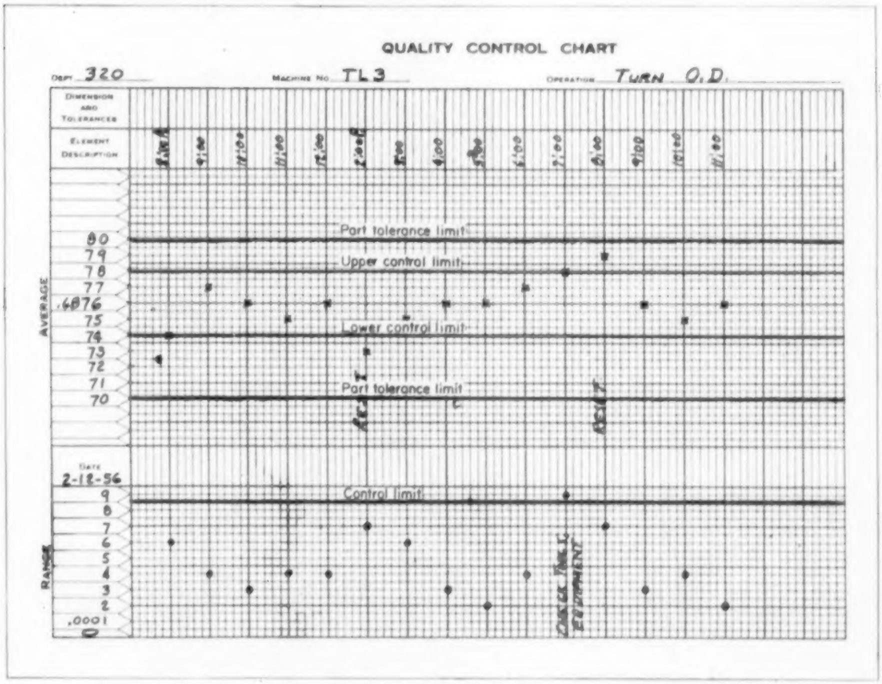
SAMPLE DESIGNATION	1	2	3	4	5
SAMPLE READINGS OR MEASUREMENTS X	.6875	.6877	.6875	.6875	.6877
	.6877	.6879	.6877	.6877	.6874
	.6873	.6877	.6877	.6873	.6874
	.6871	.6875	.6876	.6875	.6878
	.6874	.6878	.6874	.6873	.6877
SUM OF SAMPLE READINGS	3.4370	3.4386	3.4379	3.4373	3.4380
AVERAGE of each Sample $\bar{X}$ (Plot on Chart)	.6874	.6877	.6876	.6875	.6876
LARGEST VALUE	.6877	.6879	.6877	.6877	.6878
SMALLEST VALUE	.6871	.6875	.6874	.6873	.6874
RANGE of each Sample R (Plot on Chart)	.0006	.0004	.0003	.0004	.0004

	6	7	8	9	10	11	12	13	14	15
Readings	.6871	.6877	.6876	.6875	.6878	.6880	.6883	.6874	.6876	.6875
	.6874	.6878	.6877	.6876	.6880	.6873	.6879	.6876	.6877	.6877
	.6871	.6875	.6875	.6876	.6876	.6879	.6880	.6877	.6875	.6876
	.6872	.6873	.6875	.6875	.6877	.6882	.6879	.6875	.6875	.6876
	.6878	.6872	.6878	.6877	.6876	.6874	.6876	.6876	.6873	.6876
Sum	3.4366	3.4375	3.4381	3.4379	3.4387	3.4388	3.4397	3.4378	3.4376	3.4380
Average	.6873	.6875	.6876	.6876	.6877	.6878	.6879	.6876	.6875	.6876
Largest	.6878	.6878	.6878	.6877	.6880	.6882	.6883	.6877	.6877	.6877
Smallest	.6871	.6872	.6875	.6875	.6876	.6873	.6876	.6874	.6873	.6875
Range	.0007	.0006	.0003	.0002	.0004	.0009	.0007	.0003	.0004	.0002

AVERAGES	RANGES
.6874	.0006
.6877	.0004
.6876	.0003
.6875	.0004
.6876	.0004
.6873	.0007
.6875	.0006
.6876	.0003
.6876	.0002
.6877	.0004
.6878	.0009
.6879	.0007
.6876	.0003
.6875	.0004
.6876	.0002
10.3134 TOTAL	.0068 TOTAL
.6876 GRAND AVERAGE $\bar{\bar{X}}$	.0004 GRAND AVERAGE $\bar{R}$

LIMITS FOR RANGES CHART = $D_4\bar{R}$ and $D_3\bar{R}$	LIMITS FOR AVERAGES CHART = $\bar{\bar{X}} \pm A_2\bar{R}$	FOR A SAMPLE OF 5
2.114 X .0004 = .00085	.6876 ± .577 X .0004	D_4 = 2.114
UPPER .00085	UPPER .6878	D_3 = 0
LOWER 0	LOWER .6874	A_2 = 0.577

Fig. 3. (below) Quality control chart indicates trends of average part size and range variations during a 15-hour production run.



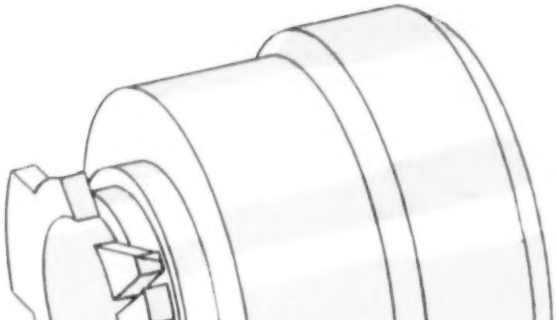
designed for PRODUCTION

INTERMITTENT CUTS Generate Lead

By Albert Bethke*
Tool Process Engineer
Argus Cameras, Inc.
Ann Arbor, Michigan

UNUSUAL tooling is required to ensure the accuracy of the new Argus interchangeable lens system. With this system, based on use of a socket on the camera and a matching bayonet on each objective lens, lenses can be easily interchanged to meet photographic needs. When the bayonet is inserted in the socket and rotated, the objective lens is accurately located relative to the film plane and coupled to the range finder. The lens can be inserted

*Senior member ASTE Ann Arbor Area chapter.

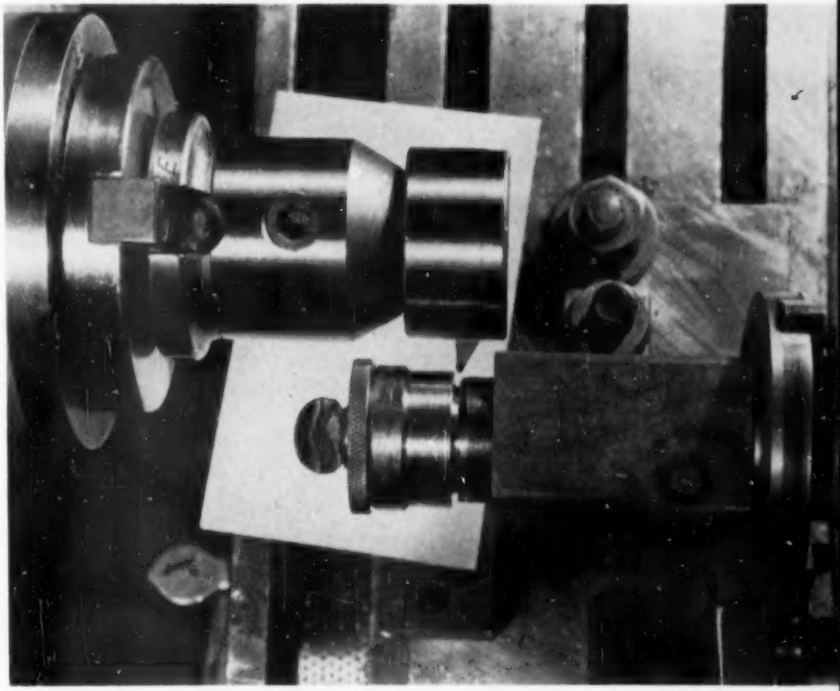


ONE OF THE bayonet ears includes a diagonal slot to receive a spring-loaded lever that is attached to the socket. As the lens mount is rotated, this lever climbs the inclined plane on the slotted ear. When the levers drop into the slot, continued rotation is impossible. The bayonet is thus positively located.

BAYONET BLANK is placed on an arbor attached to the work spindle of a gear shaper and the special cutter is mounted on the cutter spindle. These spindles rotate at the same speed. Operation is similar to shaping a fine-pitch spur gear except the cutter must work in a confined space. Completed part is shown meshed with the cutter but without the clamp washer.

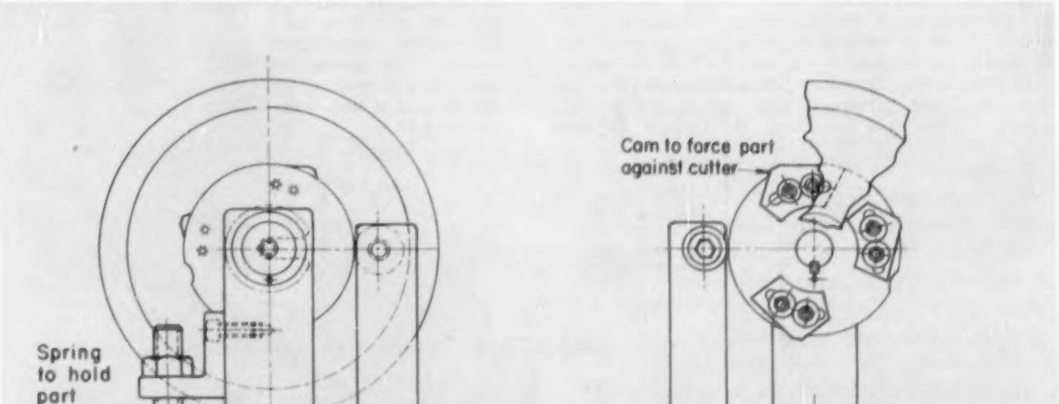
in only one position because the three bayonet ears are unequally spaced.

The brass bayonet is made from a screw-machine blank. The ears have parallel sides and are equal in width. These ears are machined on a conventional gear shaper. Subsequent operations are straightforward except for milling a lead angle on the inside leading edges of the ears. This angle is necessary for easy engagement when the bayonet is turned in the broached socket. The lead is longer on one ear than on the other two.



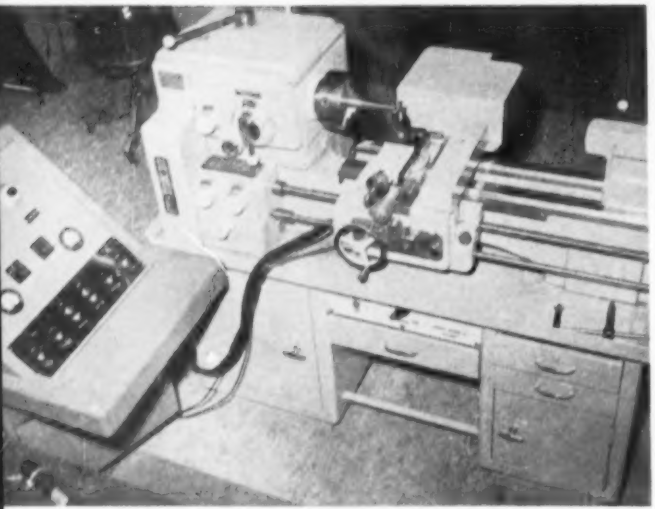
WORKPIECE is rotated in a simple hand-operated fixture and lead is machined in the ears by a special cutter mounted on a horizontal milling machine.

WHEN ROTATED through 360 deg by the handwheel of this fixture, the bayonet is forced into the cutter by the action of three cams. These cams, and the configuration of the cutter, generate a long lead on one of the ears and a short lead on the other two.



LINEAR POSITION TRANSDUCER

controls machine tool movements

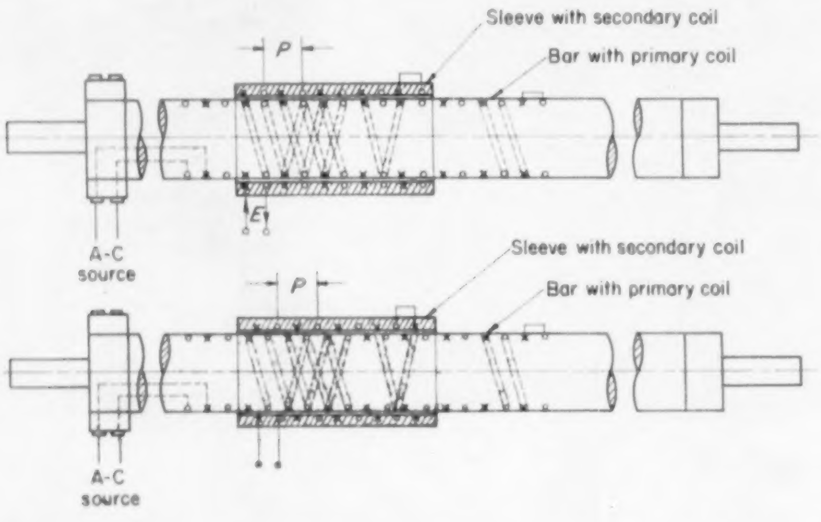


POSITION CONTROL applied to engine lathe accurately positions the tool. Control action is not affected by frequency level, external fields or proximity to metal. Mechanical wear in the transducer and wear in the machine drive units do not affect accuracy.

THROUGH the conversion of dimensional data into precise electrical equivalents, a helical differential transformer is used to accurately position linear moving members to within 0.0001 inch. The primary portion of this unit consists of a long insulated cylindrical bar in which two grooves are cut in the form of a two-start spiral. The primary winding wire is held in these grooves, the two wires being joined at one end and connected to slip rings at the other end. This results in a long bifilar coil. The secondary winding is also a bifilar coil, wound to the same pitch as the primary and positioned on the inside of a sleeve. This sleeve fits snugly around the primary but is free to slide.

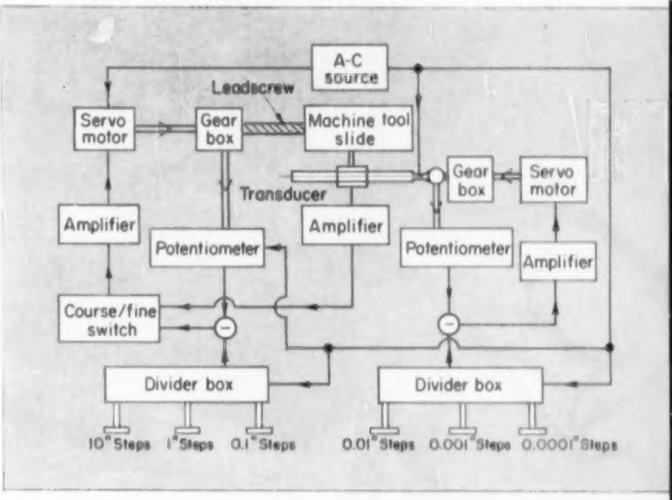
The transducer, developed by Canadian Westinghouse, forms the basis of two control systems applicable to the machine tool field. One is a manual-

BIFILAR WINDINGS do not produce an electromagnetic field within the coil but each turn is surrounded by a fringe field when carrying current. Circles and crosses represent wires carrying current in opposite directions. When the secondary winding lines up with the primary, as in the top sketch, voltage E is induced in the secondary winding. If the secondary is moved a distance equal to one-half the pitch, each turn of the secondary lies equidistant from the two associated primary turns, as in the bottom sketch. Under this condition, no voltage appears across the secondary terminals. Continuing to move the sleeve in the same direction results in the induced voltage again rising to a maximum but in the opposite phase. Output voltage is a sinusolidal function of the relative position between the two coils. Around the zero points or nulls, the transducer acts as a differential transformer giving a phase sensitive output. The system has stable points at distances equal to the lead of the windings. The longitudinal position of a null can be changed by rotating the primary bar.



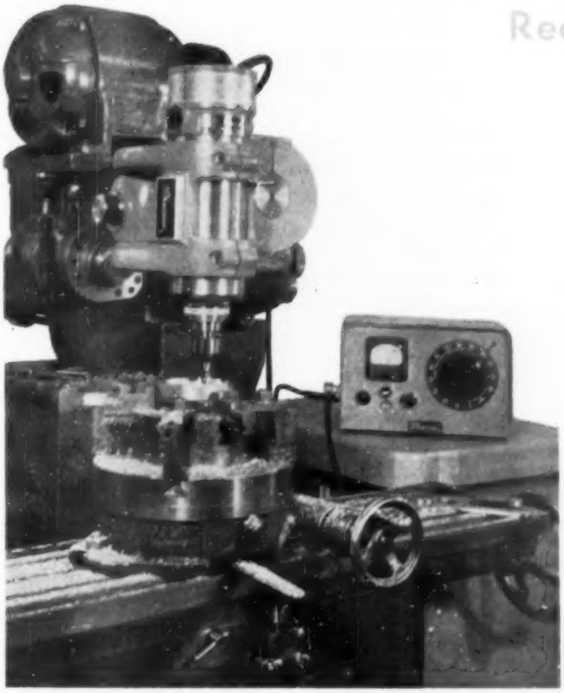
control precision measurement system that allows an operator to set his machine with high accuracy. In its simplest form, the pick-off coil is rigidly attached to the machine tool slide. The table is conventionally moved to within 0.1 inch of the desired position. Primary of the control is rotated to the desired reading and the table is moved until a null is indicated on the meter. Remote operation is possible with this system when servos are used.

The other type of control system uses a closed loop in which the transducer output is fed into a servomotor connected to the drive linkage. Such systems can be used to control in several coordinates through use of tape or punched cards. Nonlinear shapes can be made with high accuracy.



TYPICAL positioning control system. Operator sets up reading, in terms of distance from the datum line on the two divider boxes. Error voltage resulting from the difference between the coarse divider box and potentiometer settings causes the servomotor to turn the lead screw until this voltage falls below a certain value. At this point, the fine system takes over control. Final positioning is accomplished by rotating the primary of the transducer by a servomotor.

High-Speed Power Quill Reduces Production Costs



HIGH-SPEED power quills have found wide favor for many production jobs but their application has been limited by low power. A quill, designed by Precise Products Corp., develops 1½ hp and has a continuously adjustable speed range between 7,000 and 25,000 rpm. The separate speed control unit has a simple dial with which the speed is set and a voltmeter calibrated in revolutions per minute.

Either collet chucks or solid quill extensions for grinding wheels can be used with this unit. The special mount enables attachment of this power quill on large, standard machine tools. The universal motor operates from a standard 115-v supply. Five grease-sealed small, precision ball bearings and a rigid quill permit milling, grinding or finishing to tolerances of 0.0001 inch.

PATENT OR SECRECY

for shop tools and processes

By Richard H. MacCutcheon
Patent Attorney
Cleveland, Ohio

Ideally, all information should be available to everybody and progress would be faster. In the modern business world, however, management is responsible for showing a profit. The author indicates the reasons behind a decision to patent or keep secret a development that will not be for sale.

TO PATENT OR NOT to patent is an important decision in manufacturing. To the manufacturer of a salable product—consumer, industrial or tool—there is little question. By obtaining a patent, he has the opportunity of protecting his rights, recovering his development expense and obtaining a return on his ingenuity. Similar considerations apply to processes that can be used only in connection with equipment available for sale, or processes that are marketed by organizations that sell or license ideas rather than articles.

For the manufacturer who develops a patentable tool or process during the course of his product manufacture, the question of whether to patent or not is often perplexing. It need not be if he considers all aspects of the question. Answers to a few simple questions determine the desirability of keeping secret or filing an application for patent. For example, it has been said by some of the country's largest manufacturers that it is not usually worth while to take out patents on shop tools, utensils and processes that will be used only in the company's own factories. Naturally, there are many exceptions to such a rule, but it provides a good starting point.

The accompanying check list of reasons for and against patenting a tool or process development may be helpful in clarifying the question. When using this check list, however, it is important to consider whether the idea can be kept secret. It is easiest to keep a secret if the idea is not used; the idea might not warrant the required expense in light of current methods. However, the inventor is usually free to leave his job at any time and may take the idea with him to a competitor.

If the development is used, any one of the following classes of people may intentionally or unwittingly let the secret out:

1. Employees (including garrulous ones at cocktail parties)
2. Ex-employees
3. Vendors
4. Favored customers
5. Other outsiders afforded access to the information or plant
6. Advertising agency representatives
7. Trade association representatives
8. Detectives
9. Friendly or hostile witnesses forced by deposition, "discovery" or trial procedure to testify whenever, with or without reasonable grounds, a lawsuit has been filed.

Detectives are included in this list because industrial espionage is practiced. There is at least one agency doing a flourishing business throughout the country discovering industrial plant secrets, patent infringements and the like. Operators pose as meter readers, financial analysts, equipment salesmen and even employees.

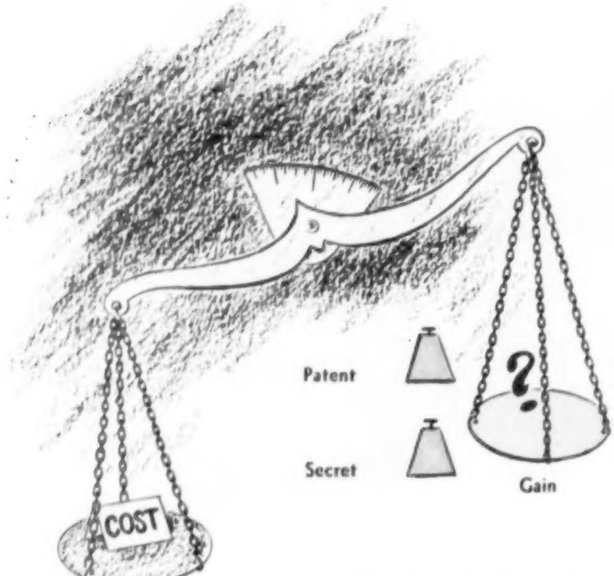
In these confusing days of high costs and ofttimes

It's a Secret!

Check List of Reasons

for and against patenting of nonsale items

Patent	Trade Secret
Protects position if there is any possibility of future sale or license of a tool or process	*Protects position by not giving access to development through a 25-cent expenditure for patent copy*
Protects company expenditure of development cost by permitting filing of suits for infringement	*Recognizes difficulty of enforcing patent because of lack of information on use by others*
Can bring income through sale or license of idea, or sale of product	*Saves probable patent cost of anywhere from $300 to $2000*
For trading purposes in field where similar patents are held by competitors	*If ideas can remain secret, there is no need for trading or cross licensing*
Protects against others patenting the item and then hampering freedom of use	*Defensive protection not necessary if secret can be retained*
Stimulates inventive employee by offering tangible recognition	*Employee might rather have probable patent expense as a bonus*
Can be used in advertising and to build prestige for the company	*Customers are more concerned with product than methods of manufacture*
Indicates protection of investment to promoters and investors	*Patent offers no protection if copying can be kept secret*
Assures a profit by minizing competition	*Assures a profit by competitive advantage*



The Right Decision Balances the Scale

low returns, the businessman cannot afford to forget economic facts. A producer's markets and solvency are still influenced by actions of his business rivals; competition still exists and still carries with it the risks of loss and possible ruin. One legal advantage that the businessman may use to meet these risks is the limited patent monopoly specifically authorized by the U. S. Constitution, given breadth and body by the Congress, and often enforced by the Courts.

Patent statutes presuppose that in exchange for the 17-year right to exclude others, which the inventor or his assignee receives by virtue of the patent grant, the inventor will fully disclose his idea so that the public will have it and can use it as soon as the 17-year period expires. However, all pending patent applications are preserved in absolute secrecy by the Patent Office. The same is true of patent applications abandoned by failure to prosecute or by failure to pay the final fee when the application becomes "allowed."

For the owner of a shop tool or process invention, this means that the decision to disclose or not disclose can be postponed for from three to seven years or longer. He can file for patent at once (to prevent someone else from patenting, or to avoid a one-year public use, or "sale," or publication bar against ever filing later) and then let events take their course. When the patent application has been allowed, he can then:

1. Take a new look at the situation
2. Determine the possibilities of information leaks that might have resulted from any cause
3. Again balance all reasons (except cost of patent) for and against patenting
4. See whether any competitor has caught up to the extent that trying to deny access to a patent copy has become less important than obtaining a patent so that such competitor may be
   (a) Stopped cold on the development for 17 years
   (b) Made to pay royalties to assist in paying for the original cost of the development.

The United States patent system was set up to promote invention, invention has become an integral part of manufacturing as well as design. The decision to patent or not is now based on the overall picture of benefits to be derived. A patentable development may be kept secret but patents are available so that no one shall reap where he has not been the first to sow.

Knowledge Goes with Employees

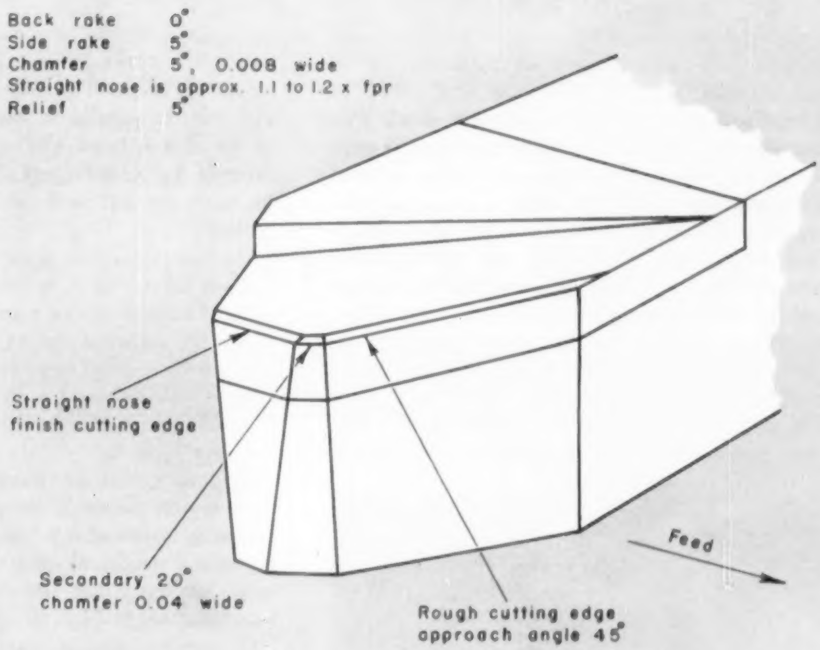


Fig. 1. Pictorial view of the Kolesov tool, showing rakes, reliefs and cutting edges. The secondary chamfer flattens the chip and avoids sharp corners. It can be replaced by a 0.04-inch radius.

experience with the KOLESOV TOOL

By Henry W. Stier*
Windsor, Ont., Canada

ALTHOUGH REFERRED to as a "high-precision" lathe tool[1], the Kolesov tool is better described as a "high-production" tool. With this tool, *Fig.* 1, however, tolerances cannot be held closer than 0.002 inch on production runs. This design offers advantages over conventional tools but its application is limited. Workpiece diameters cannot be less than 1 inch or less than 3 inches if the length exceeds 5 times the diameter. These diameter limitations result from increased pressure on the cutting edge and the large contact area between the tool and workpiece. Kolesov tools have the same tendency toward chattering as conventional tools with large cutting point radii.

Geometry of the Kolesov tool causes the chip to break into two parts to provide a roughing and finishing cut at the same time. It has a straight nose, the length of which is greater than the feed per revolution. Tools of this design have been used for several years in Europe to reduce machining time on heavy components. Negative chamfers, varying from -5 to -10 deg, 0.005 to 0.030 inch

[1] THE TOOL ENGINEER, pp. 106-107, August 1956.
*Senior member ASTE Windsor Chapter.

wide, on back and side rakes, and the 0.005 to 0.010 inch straight land on relief are hand-honed or ground with a 320 to 500 grit diamond wheel. This increases the life of the Kolesov tool just as such honing can increase the life of any carbide tool used for machining steel. The same practice is often applied in Europe on the end and side relief, *Fig.* 2. This design increases tool life and reduces possibility of chatter. Experience with a conventional tool has shown that when machining high alloys, stainless or titanium, the nose radius should be replaced by a secondary chamfer on the lead angle to obtain greater tool life.

Mounting of a Kolesov tool is critical. To prevent chatter, the cutting edge must be horizontally positioned within ±0.003 inch of the workpiece center for height. The straight nose of the Kolesov tool must be parallel to the axis of the workpiece or the surface finish will be poor. Some modifications of the Kolesov tool give as good results as the basic tool but need not be positioned quite as critically.

Carbide face milling cutters, ground to a modified Kolesov form, *Fig.* 3, have also been used successfully. Cast-iron intake manifolds with hardnesses of 190 Bhn have been milled using a 7-inch diameter inserted-blade cutter with 22 teeth. With Grade C-2 carbide: cutting speed is 320 sfpm, feed is 28 ipm, chip load per tooth is 0.010 inch and depth of cut averages ⅛ inch.

Originally, the cutter was ground to conform with the geometry shown in Design *A*, *Fig.* 3. The face mill with inserts of this type could cut 300 to 400 pieces and remove about 1000 cubic inches of material between grinds. By changing to inserts with Grind *B*, 2000 to 2400 pieces were cut and 5000 to 6000 cubic inches of material removed between grinds. These figures are based on 10 weeks of observations during which period results remained consistent. The wear land on cutter Design *B*, after producing 2000 parts, did not exceed $\frac{1}{32}$ inch. After producing 400 parts with Design *A*, the wear land was $\frac{1}{16}$ inch. An increase of feed to 40 ipm has been tried and proved possible. In this application, however, production could not be increased because cycle time was dependent on succeeding drilling stations on the transfer machine.

Increased feed has no influence on surface finish, which varies between 70 and 90 microinches, rms. Variation in number of pieces per grind results from differences in microstructure between various lots of castings.

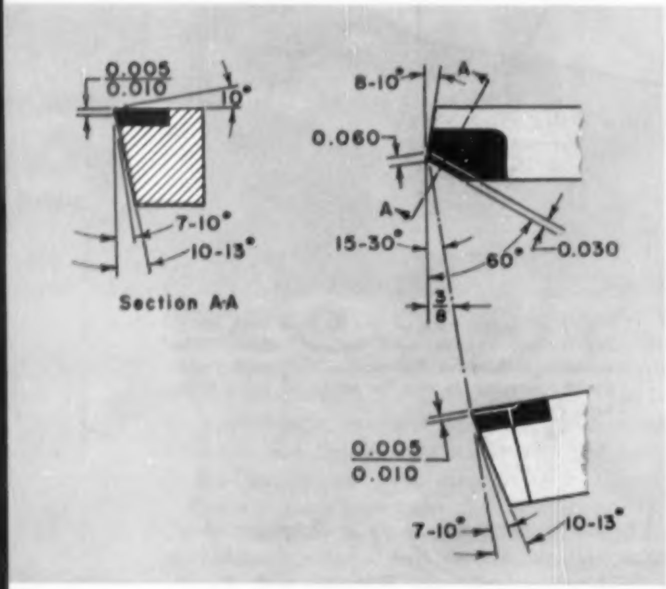


Fig. 2. (above) Modified Kolesov tool for cutting high alloy, stainless or titanium. A roughing and a finishing cut are taken with this tool in one pass.

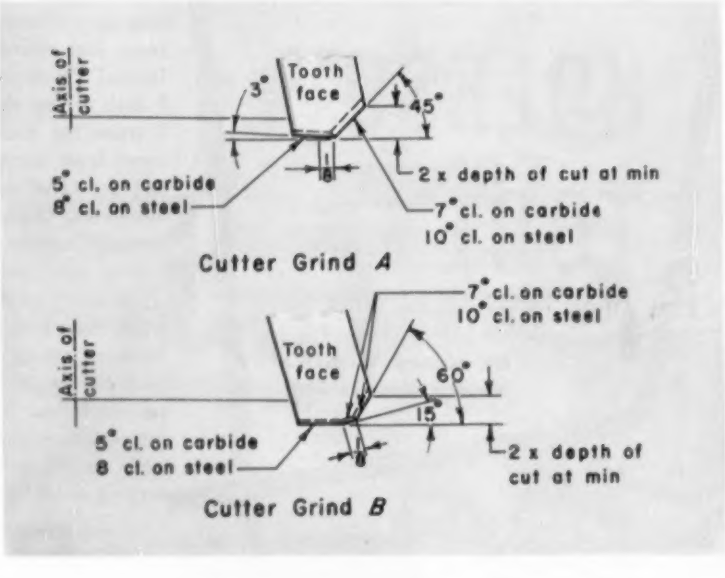


Fig. 3. (right) Two modified designs of carbide insert blades for face-milling cutters. Both blades have axial rake of 6 deg and radial rake of -6 deg, but Grind *B* has considerably longer life.

simplified system

controls plant temperature

Blower type units suspended from ceiling permit better utilization of plant floor space.

Successful utilization of modern industrial plants largely depends on adaptability of its production space. One factor often causing complications is the growing need for control of plant temperature to assure the precision required in production. Successful control of plant temperature is achieved at Norton Company's new plant in Worcester, Mass. The building, divided into factory and office space is a large single-story structure.

Size and shape of the building and the production processes involved posed several problems for the design engineers. The plant, 750 feet long, 350 feet wide and 35 feet high, has window sills 10 feet above ground level to provide usable floor space from wall to wall. Close tolerances involved during machining parts require holding indoor temperatures close to an ideal figure. Uneven temperatures in the plant could result in workpiece variations due to thermal expansion of metals being processed.

This problem of plant engineers, of providing even air distribution throughout the entire working zone, was complicated by the variations in sizes of machines. Also, the heating system must be out of the way of large moving cranes, which traverse the entire length of the building.

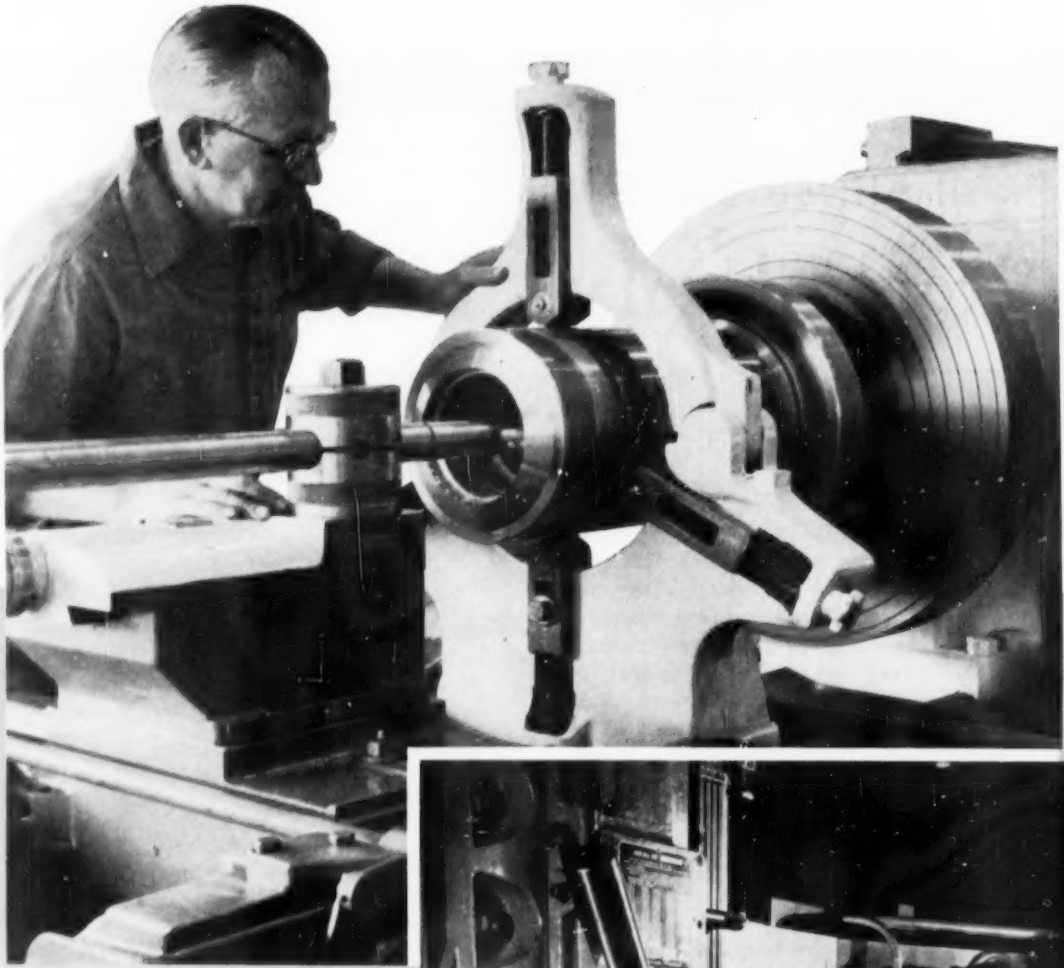
The heating problem was solved by installing 21 large centrifugal fan type unit heaters. These units, installed back to back in two rows along the center bay of the building, heat the area evenly from the center bays to the outside walls, a distance of approximately 110 feet. Eleven of the units, each having a capacity of 10,500 cfpm, supply outside air as well as recirculate the air. The remaining 10 units are for recirculating air only, each handling 10,000 cfpm. Outside air units are alternated with those for recirculating the air.

By employing this type of unit heater, with its long throw, piping is simplified by keeping the supply and return lines in the center of the building. In addition to winter heating, the system is utilized in the summer to bring in sufficient quantities of outside air to offset the heat gain from the electrical load in the building.

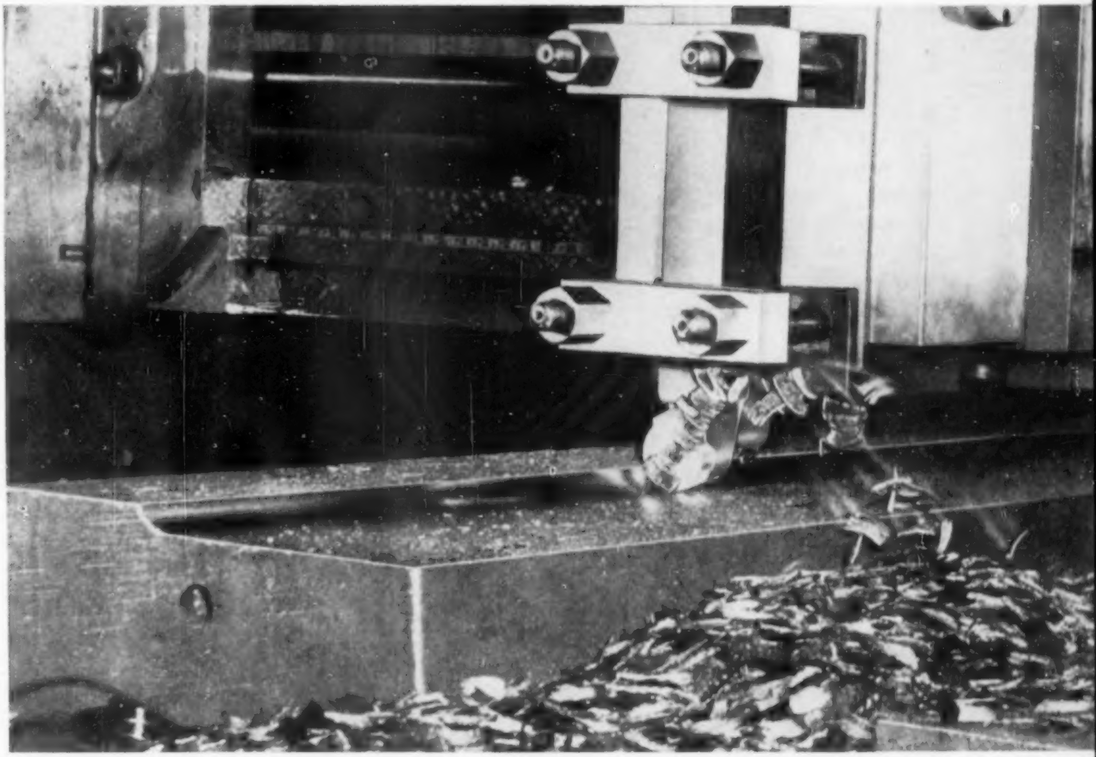
An interesting control arrangement provides zones for the heating system. A pneumatic type control system permits entrance of outside air when indoor temperatures rise above the thermostat setting. It also permits air to be recirculated, with a minimum of outside air for ventilation, when inside temperatures are below design conditions. The control system is arranged so that each unit, covering a specific manufacturing process, has an individual thermostat to sense the heating requirement peculiar to that area alone.

In addition to this zone feature, all 11 outside units are responsive to ventilation requirements of the area to be covered and provide maximum ventilation in accordance with design temperature conditions. To save fuel at night or during other unoccupied periods, some of the recirculating air units have a manual switch-over arrangement to maintain minimum temperature during these periods.

This simple, yet effective system maintains comfortable temperatures through the plant and makes special provision for the requirements of each individual machining area.



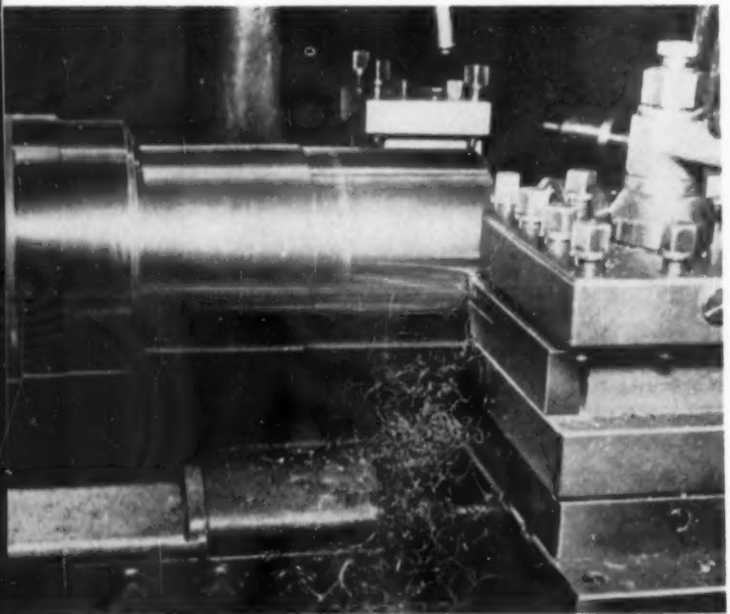
NUCLEAR TECHNOLOGY requires precision production and fine surface finish. Parts, such as this stainless volute for a canned-motor pump, are bored to 0.0001-inch tolerance with a surface finish of 1 to 5 microinches. (Bottom) Similar requirements prevail on the finish cut of threads in stator end ring for the motor pump, being produced in Westinghouse's atomic equipment department plant, Cheswick, Pa.



PLANING OF TOUGH CASTING is speeded with quick-change toolholder and specially designed carbide tip at Rockford Machine Tool Co. The cut is $\frac{5}{8}$-inch depth, being taken on meehanite at a feed of 0.060 inch, with planer table traveling at 300 fpm. Complete cut is made across entire casting with no breakouts and minimum tool wear. With this straight, rear lock holder designed by Apex Tool & Cutter Co., Shelton, Conn., the carbide button tip is indexed or changed without removal from clapper box.

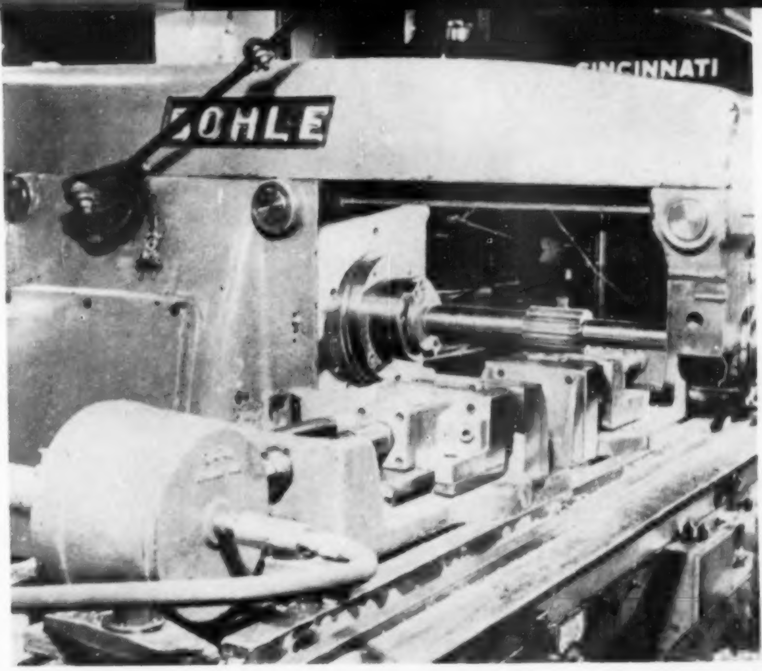
TOOLS at work

Mirroring machining progress, these pages present interesting and unusual setups from which tool engineers can learn what others are currently thinking and doing in this important area.

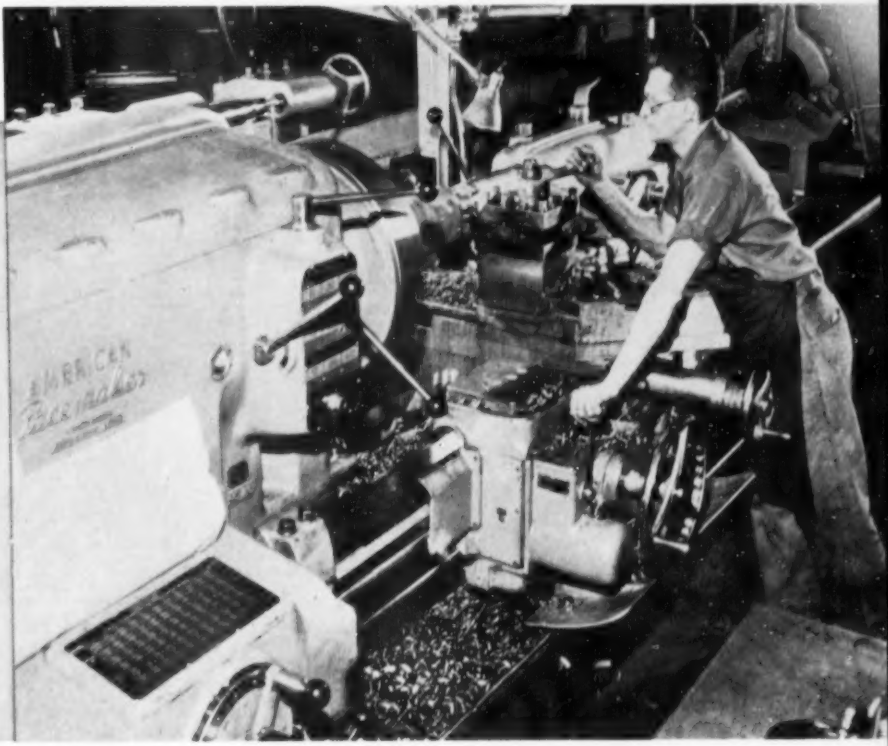


SUPERFINISH is put on brass with a diamond tool in this representative operation. Brass cylinder part is produced to a mirror finish, with average height of two microinches rms, according to Industrial Diamond Association of America.

EXTREMELY FINE CUTS are made with a ceramic tool in this finish machining operation. Workpiece is a 5½-inch diameter steel bar being turned at 1500 sfpm. Depth of cut is 0.0005 inch and feed is 0.005 ipr. Rigidity of toolholder is vital in this application of a Sintox square insert tool.



FAST SETUP in milling is achieved, even in job-shop operations, with hydraulic machine vises in this tandem arrangement. Work changing in this typical milling application is rapid and simple because air-actuation provides finger-tip control. Locking force of the vise, manufactured by Wilton Tool Mfg. Co., is 9000 lb.



TRACER-CONTROLLED LATHE completely machines a roll part at Improved Machinery, Inc., Nashua, N. H. The part is cut from a billet of 1020 steel with one Carboloy Grade 370 tool, removing 18 lb of chips per minute. A day's run is completed before a tool change is needed.

TOOLS at work

effective control

means fewer tools and gages

By Michael Curtis
General Foreman
Tool Inspection
Timken Roller Bearing Co.
Canton, O.

Experience gained with a new control procedure in the past few years clearly demonstrates that substantial savings in tool and gage costs are possible with an effective records system. While too many variables are involved to place a dollars-and-cents value on the savings, certain tangible benefits can be cited. Interruptions to production due to lack of tools or gages have been minimized. Tooling information is readily obtainable to indicate the length of lead time necessary to produce a potential order. Because tooling history is recorded, only actual numbers of tools and gages that are essential for scheduled production are ordered. Fewer tools and gages made and stocked mean lower tooling costs and less overhead. Most important, tools and gages are now located where they are needed and are available when they are required, *Fig.* 1.

Demands on the tool and gage control system at Timken are far from simple. Tool inspection must keep tabs on more than a half million expensive tools, gages and machine parts in five plants at as many different locales. Records must accurately reflect condition and physical location of each item from the time it is first authorized by tool and gage engineers until it is finally scrapped. Since most tools and gages are made in company shops, timing in scheduling their production is an important factor in cost.

Formerly, because of incomplete information, the toolroom many times would be buried under rush orders issued on tooling to avoid costly production delays. Other urgent work was sidetracked to make way for the rush orders. Skilled machinists in the toolroom were often paid overtime rates to get out rush orders. This was not only time consuming, but expensive. The new tool and gage record system has greatly improved this situation, also.

Basically, two separate filing systems are maintained. One is for production tool and gage records; the other is the master gage filing system in existence for many years to record data solely on master gages. Because of the nature of the products manufactured, the latter is quite important.

All production tools, gages and machine parts are checked against the master gages. Accuracy of master gages is established to within a range of 10 to 50 millionths of an inch. The function and character of the master gage records, *Fig.* 2, have not been materially changed in the new setup. The master gage file contains a description of the item, special dimensions not appearing on the gage blueprint, condition of the piece when last inspected, the inspector's name, location of the piece, and the inspection and reconditioning cycle for it. Responsibility for accuracy and condition of the master gage file rests with five highly trained tool and gage inspectors.

Control of production tooling is more difficult, of course, because of the number and variety of

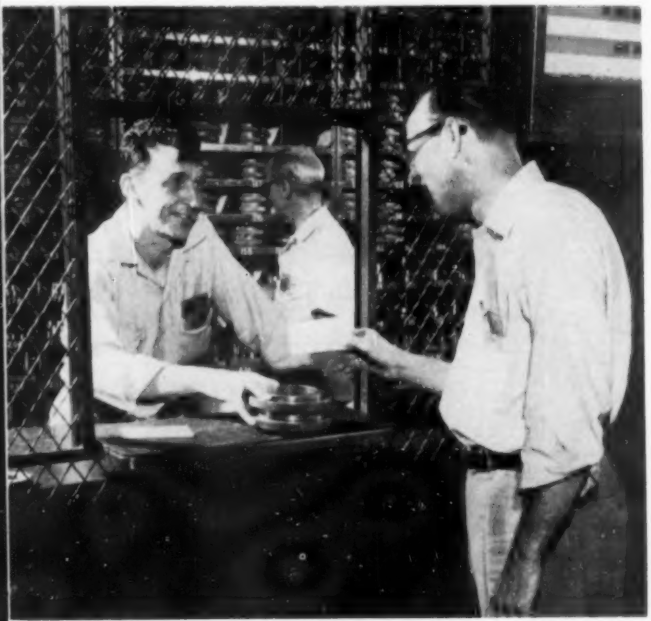


Fig. 1. (left) Crib attendant issues gages to operator after he completes tool request slip.

Fig. 2. (below) General foreman examines the record of a master gage.

departments and personnel involved in their storage, use and maintenance. Under the new plan this control is secured by a general filing system, which consists of four sets of colored cards, *Fig.* 3. Monthly production records of production parts, such as a bearing cone, are kept on the blue card. This record aids crib supervisors in determining the number of tools and gages to have on hand for the production of that particular bearing cone. These cards are filed by part numbers.

A group card, salmon color, is designed to indicate the total number of identical gages or tools used to produce a given bearing part. This record not only notes the number of the same tool, gage or machine part currently in use, but also their respective locations, blueprint number and whether an order has been entered for additional ones of replacements.

An individual record of each particular gage, tool or machine part is contained on a yellow card. This notes when the gage was first placed in service, how often it has been reconditioned or inspected. It is likewise filed by the part number of the production part for which it is required.

In addition to these three cards a fourth, inventory card, is maintained. This is green in color and shows the number of spares of a particular gage or tool available and in what tool crib.

To assure rapid location of a tool or gage in the tool crib, wall bracket files, *Fig.* 4, are conveniently located in each crib. The wall files duplicate the information in the tool and gage main files. Advantage of the wall bracket files is that they are handy and withstand rough continual use.

Entries on the general filing system are made in the following manner: when a new machine part, tool or gage is taken from inventory (as recorded on the green card) the crib attendant assigns a serial number to the item. This serial number is etched on the tool itself and recorded on the tool crib record slip.

After the date, the tool crib number, serial number, description of the tool and reason for placing the new tool or gage in service is noted, the tool record slip is sent over to the general files. There a file clerk records this information in the general files. The history (yellow) card is filled out showing when the item went into service. If it is needed for increased production, it is added to the group (salmon) card. If, on the other hand, it is simply replacing a worn-out tool or gage, the group card remains unchanged.

Much of the success of the system depends on restricting to a few persons the responsibility for keeping both tools and records accurately ac-

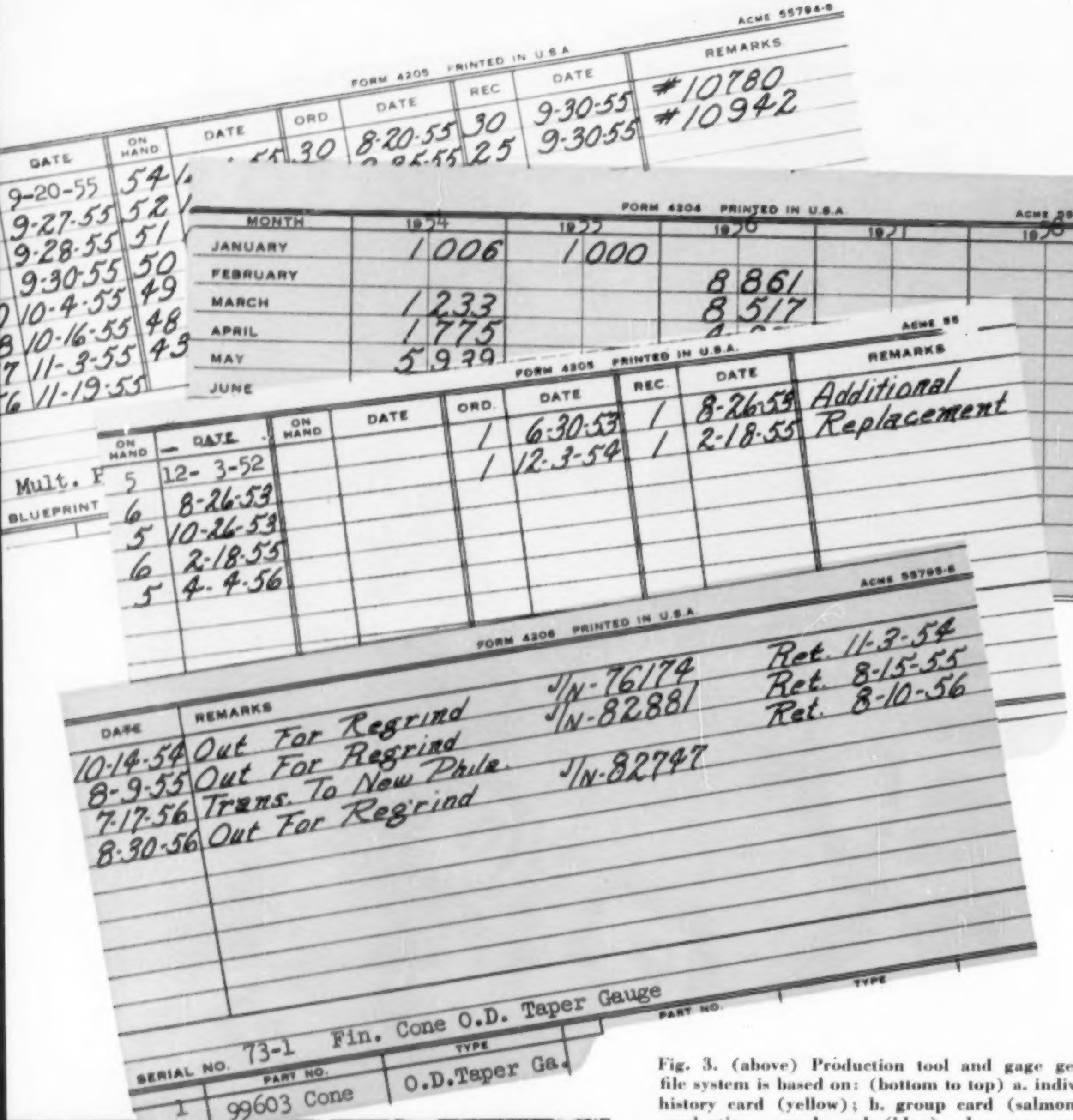


Fig. 3. (above) Production tool and gage general file system is based on: (bottom to top) a. individual history card (yellow); b. group card (salmon); c. production record card (blue); d. spare parts or inventory card (green).

Fig. 4. (left) Crib attendant checks wall bracket file for speedy location of needed tooling.

counted for. The tool inspection department has complete responsibility for quantity and quality of production tooling. This includes maintaining functional condition and determining accuracy of gaging. To discharge this responsibility, the department orders replacements when and as necessary. Specifically, the responsibility for receiving new tooling items in the tool crib rests solely with each tool crib supervisor. The responsibility for recording data in the main files, *Fig.* 5, rests with two salaried file clerks.

Another basic element of the production tooling

control system is the central record files. This summarizes all the information contained in the general file (colored cards). The central files accurately record all gages, tools and machine parts immediately available to produce a particular bearing part number. The cards, *Fig.* 6, also show the type of machine for which the bearing part is currently tooled.

The value of the central file is immediately apparent. It reveals promptly to production the quantity and type of tools available to produce a particular bearing part. The time required to produce a particular bearing part order can thus be quickly estimated. With the aid of the central file it is also possible to make much better use of equipment on hand, making more economical and faster production possible.

Another integral part of the system is the method of charge-out of tooling to production personnel. When a new production or master gage, tool or machine part, is requested by a machine operator, he is required to fill out a white requisition slip, *Fig.* 7. The operator writes on the slip the part number for which the tool or gage is to be used, a description of the item, the machine number on which a tool will be used, his time-clock number and his signature.

The crib attendant completes the form by marking the serial number of the gage on the request slip and placing his signature on the request slip. The slip is then placed in the bin where the item was removed and remains there until it is returned. Then the request slip is given back to the operator as his receipt, when the tool or gage has been returned.

The purpose and need for each record in the system has been carefully thought out with particular reference to the company's products and method of operation. Each type of card has its own function to perform and at the same time helps to reduce tooling and production costs.

For instance, since the records pinpoint locations and quantities of tools and gages, unnecessary duplications are now eliminated. Tools and gages used for bearing parts produced in smaller quantities now are rechecked for accuracy less frequently than formerly. On the other hand, those used on high-production parts are checked frequently and regularly.

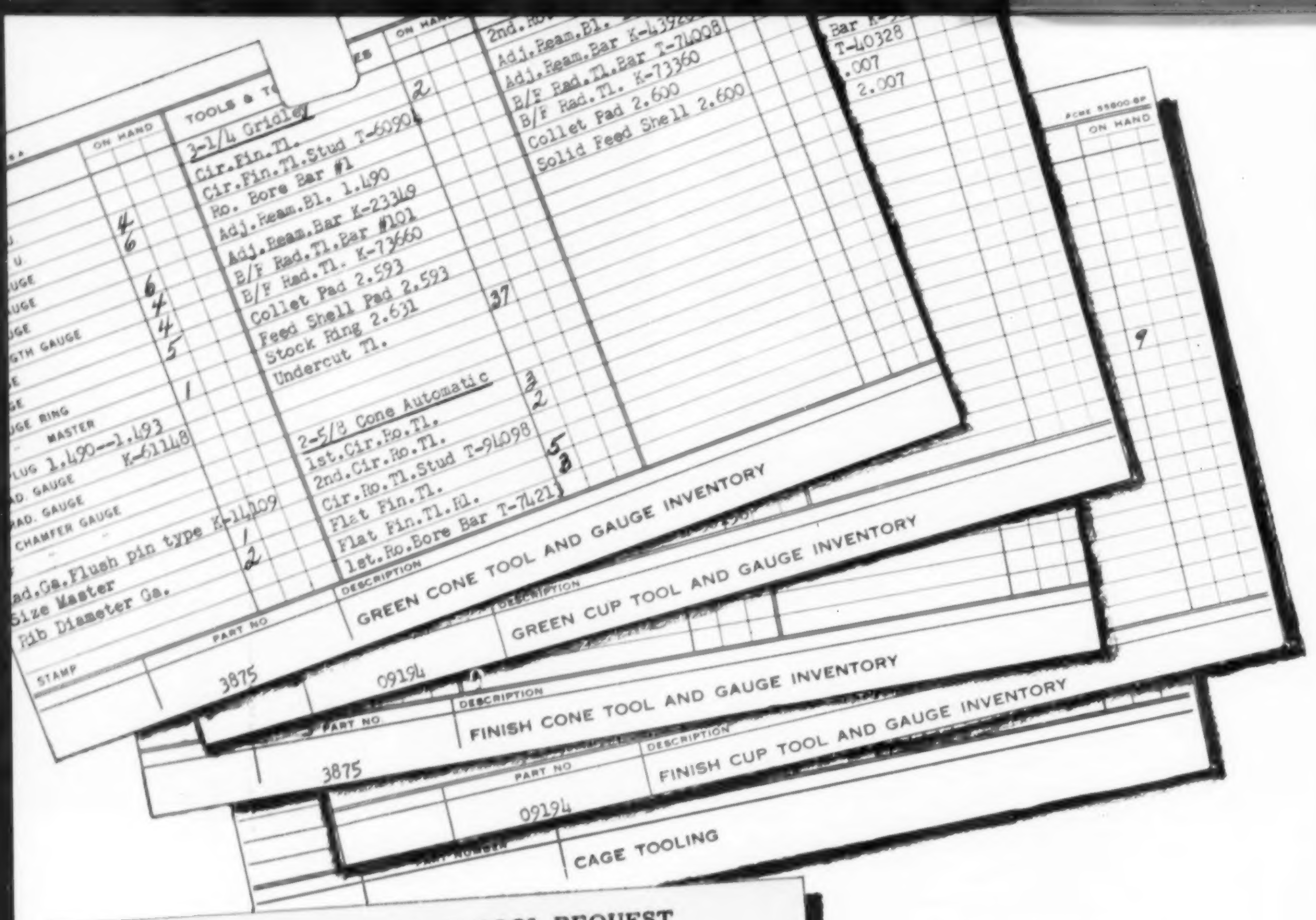
When there is a change in bearing part number dimensions, all tools and gages for that particular piece-part must be called in. Either new tools and gages of proper dimensions are issued or the old ones changed as required. If some of the old gages are somehow overlooked and are not changed or replaced, it is quite possible that obsolete tooling would be used on the bearing piece-part, creating considerable needless waste. The new control system assures an accurate count of all the old tooling. The tool inspection department can now determine at a glance whether or not all the old tools and gages have been returned and where to look for the missing ones.

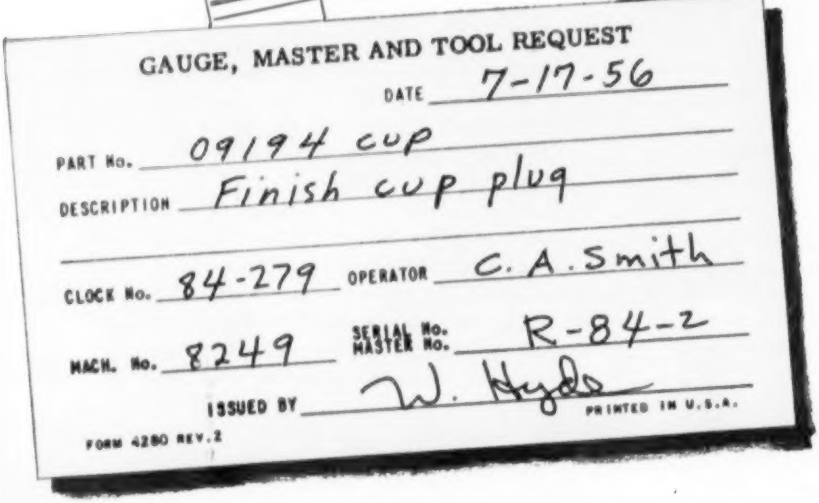
Fig. 5. File clerk makes entry in central file record from tool record slip received from one of the tool cribs.

Machine setup time is also reduced because of the production gage control program. When production gages of a particular group are called in for dimensional changes, only one machine setup is needed for the entire group. Before the general files were established, it was difficult to know whether all the production gages of a particular group were actually in. Often, gages would be received for dimensional changes months after the scheduled date. This, of course, required an entirely new machine setup. The new system has entirely eliminated this duplication of expensive setup time.

As noted, each crib supervisor is responsible for the proper inventory of tools and gages. If an order came in for which there was an inadequate supply of tools and gages on hand, the crib supervisor, and only he, was responsible. Because of this, crib supervisors were often extremely reluctant to transfer any tools and gages out of their cribs even temporarily. They could never be sure when tools and gages asked for by another department might be needed in their own area.

Obviously such a system was rigid and inflexible.





GAUGE, MASTER AND TOOL REQUEST

DATE 7-17-56

PART No. 09194 cup

DESCRIPTION Finish cup plug

CLOCK No. 84-279 OPERATOR C. A. Smith

MACH. No. 8249 SERIAL No. MASTER No. R-84-2

ISSUED BY W. Hyde

PRINTED IN U.S.A.

FORM 4280 REV.2

Fig. 6. (above) Typical cards from the central file showing tooling needed for production of the parts represented.

Fig. 7. (left) Tool request form, which is filled out by machine operator in order to receive tool or gage.

Now, however, with an accurate record of the use a particular tool or gage received in the preceding year, the crib attendant can predict with considerable accuracy whether or not a particular tool or gage will be used at a given time. He is, therefore, willing to transfer to another location tools and gages from his crib, which are not needed at the moment. Greater production flexibility and lower tooling costs result.

Further, before the inception of the new system it was possible for a crib attendant to literally search for days for a tool or gage which he thought was somewhere in the plant. Sometimes such an item did not even exist. The new records completely eliminate such unnecessary waste of time in chasing after nonexistent tools and gages.

Since the installation the new system has operated smoothly and efficiently. Because the purpose and function of each form was carefully considered in advance, no significant changes have been required. In fact some of the benefits cited, which resulted from adoption of the control system can be considered as an additional bonus, over and above what might have been expected or even anticipated.

how to machine plastics

part two — cutting and turning

By Robert A. Wason
Associate Editor

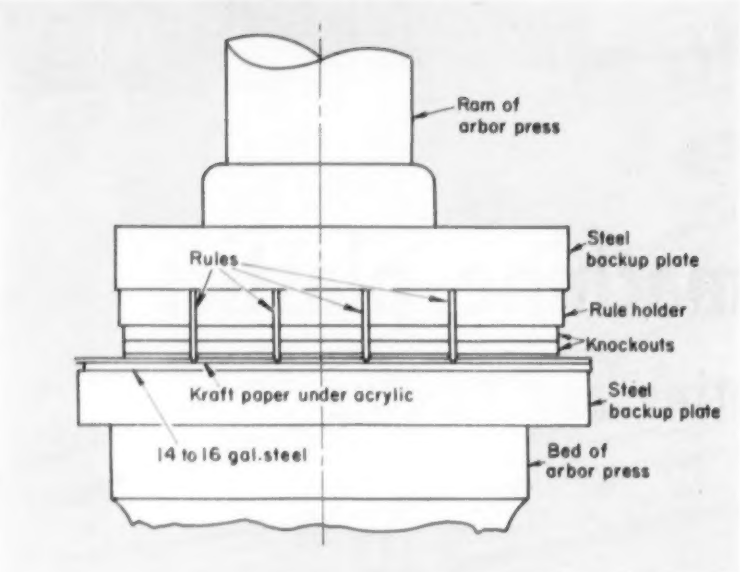

Photo courtesy Westinghouse Electric Corp.

Fig. 1. Simultaneous turning and boring operation on a laminated plastic tube is performed on a conventional metalworking lathe.

Now that plastics have taken their places as engineering materials, it is important that tool engineers know how to work with them. When they were first used, under emergency materials shortages, they suffered from misapplication and received an undeserved bad name. Moreover, because the characteristics of plastics were not understood, they acquired a reputation for causing difficulties in machining. Today, plastics are being applied in accordance with their capabilities and, based on extensive experience, the machining of plastics does not appear so formidable. They can be machined readily if their basic properties and characteristics are taken into account, *Fig.* 1.

Prior to machining, plastic blanks are prepared by sawing or by various cutting and punching processes. Also, machining may be a secondary operation following a molding process. Once the blank has been obtained, standard machining processes can be adapted for the finishing of plastic parts.

Cutting: Individual plastics pose different problems when they must be cut, punched, stamped, sheared, die-cut, blanked, etc. For example, experience has shown that certain plastics will shear



Drawing courtesy Rohm & Haas Co.

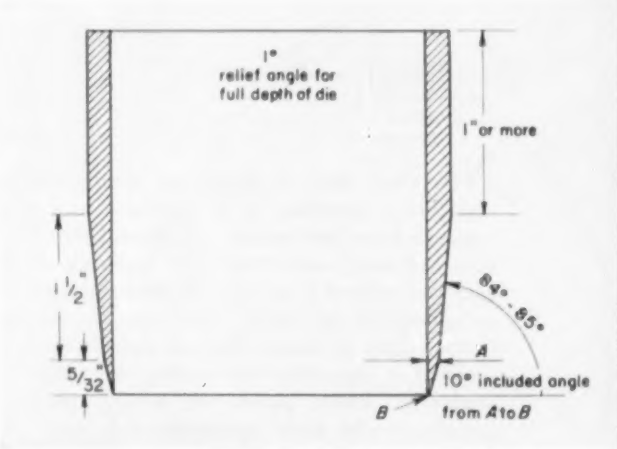
Fig. 2. (left) Rule die set up for stamping acrylic plastic. The plastic will go between the 3/16-inch sponge-rubber knockouts and the kraft paper. The rules are ⅞-inch double-bevel standard hardened stock. The rule holder is jig sawed in hard wood or pressed wood.

successfully when one side of the sheet is up but will chip along the edge if the other side is up. Other plastics require preheating before they can be sheared at all.

When a plastic sheet is heated, it becomes pliable and the weight of the blade or cutter compresses the material slightly. When the pressure is relieved after cutting, the material resumes its normal size and one edge is slightly concave; the other is slightly convex. It is almost impossible to obtain both a smooth cut and a straight edge at the same time, especially in a thick sheet. In thicknesses under 0.1 inch, the curved edge is unnoticeable. If curved edges are objectionable, edges must be finished after cuting.

Punching and shearing of cast-acrylic sheets have been found impractical, but the material can be cut easily with rule and blanking dies. Material over 0.080 inch thick must be heated to the forming temperature before stamping. Material thinner than this can be stamped cold to approximate dimensions. Routing or sanding will be required for finished edges. Small diameter holes, ⅛ inch and under, can be cold punched in acrylics up to ⅛ inch thick with reasonable accuracy.

Thickness, oven temperature and time in oven for obtaining the cleanest cuts with rule dies are shown in Table 1. When acrylics thicker than ¼ inch are stamped, the surface of the sheet should be hotter than the center. This allows the cutting edge to enter the sheet easily and prevents dragging. After stamping, the pieces should be reheated to forming temperature so that the edges will be squared.



Drawing courtesy Rohm & Haas Co.

Fig. 3. Modified shoemaker die used for stamping thick acrylic plastic sheets.

When intricately shaped parts are to be formed and dimensional tolerances are not close, they can be rule-die stamped to final shape, reheated and formed economically. Reheating removes any mark-off caused by the stamping operation, squares up the edges and makes it possible to form the piece at the same time. Steel rule dies, *Fig.* 2, are used for acrylic sheets ¼ inch and thinner. Thicker

Table 1—Conditions for Clean Die Cuts in Acrylics

Material Thickness (inch)	Oven Temperature (C)	Time in Oven (minutes)	Load per Lineal Inch (lb)
Rule Dies			
0.060	160	4	1000
0.080	160	6	1000
0.125	160	6	125
0.250	160	8	163
Modified Shoemaker Dies			
0.375	160	10	163
0.500	160	12	234
0.625	160	15	234
0.750	160	20	264

material will require dies, *Fig.* 3, similar to those used in the leather industry. Stamping is recommended only where intricate shapes are required or where the part is to be formed. The additional operations of heating and reheating will be more expensive than standard machining operations for parts that are to be used flat.

Blanking dies can be used instead of rule dies where the edge finish is not important. Blanking dies tend to drag in material from the top surface, marring the edge and leaving a bevel. Also blanking dies are more expensive than rule dies except in the standard sizes and shapes. Circular holes can frequently be drilled or fly cut less expensively than they can be stamped.

Cracking and crazing usually occur when standard punching operations are carried out with polystyrene. This is brought about by bending and cold working that accompany punching. To punch regular and modified polystyrenes successfully, it is necessary to reduce these unwanted actions and form the hole by a cutting or shearing action. This is accomplished by maintaining close clearance between the punch and die, and by controlling the punching force and speed.

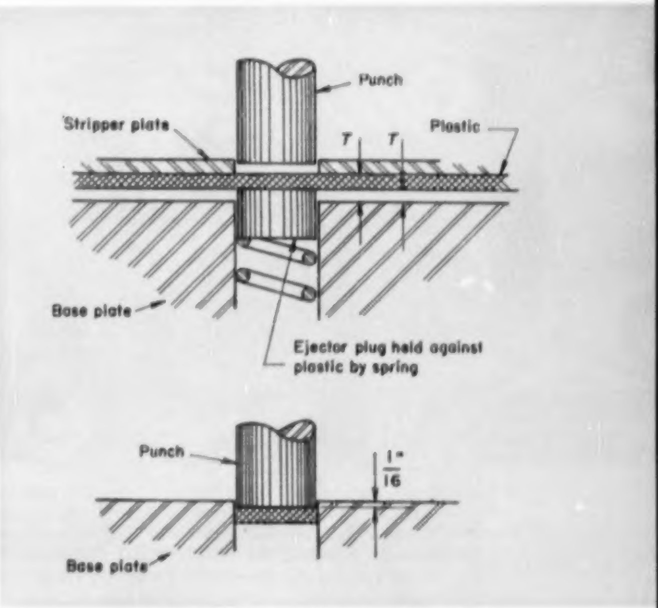
The sheet must lie perfectly flat against the ejector plug and the forming die must have a perfectly flat base and contact the plastic squarely, *Fig.* 4. This prevents cracking or straining prior to the actual punching. Clearance between the punch and base plate should not exceed 0.002 inch per side. With such small clearances, the plastic can fail in shear only.

The ejector plug is necessary to prevent bending of the plastic, which would occur if an open die were used. The spring force need only be great enough to support the plastic while the punch is raised. Inertia force of the plug is sufficient to prevent bending during punching. Punching speed should be set after trial but is usually less than that for a similar metal punching operation. A stripper plate is required to prevent the plastic from sticking to the punch as it is withdrawn. The plastic should be at room temperature or slightly higher.

Squares and rectangles can be cut from extruded cellulose acetate butyrate sheets by power-operated presses such as the paper cutter used by printers. Hold-downs should be used to prevent the sheet from creeping. When pieces are stacked, cardboard or paper between the sheets will provide a cleaner cut. Other shapes can be cut in punch presses or in blanking presses, depending on the thickness of the sheet and the number of blanks required. Punch presses for metal can often be used without modification.

For blanks of one square foot area to be used with 0.030-inch or less material, blanking dies can be of the knockout or pickup type. Either of these dies can be moved around in the die area. Knockout types can be fastened to the upper platen and the sheets moved for semiautomatic operation. In either case, the die contacts a soft-metal bedplate after cutting through the sheets. A steel-rule die is an inexpensive form of knockout die suitable for short runs on thin stock. Sheets can be stacked within the distortion strength of the flexible steel strip.

Acetate plastics can be sheared, die cut and



Drawing courtesy The Dow Chemical Co.

Fig. 4. Punch-press set up for punching regular or modified polystyrene sheets. Punch and die clearances are much less than those satisfactory for punching sheet metal.

scored. *Fig.* 5. Results when punching cellulose propionate depend on the formulation, temperature and thickness of the molded piece and processes should be set up only after trial. Phenolics can be cut with standard cutting and carving equipment. Polyethylene can be sheared, die cut and stamped without trouble. Rigid vinyl can be cut with any guillotine or pivoter's knife. Speeds and clamping pressures vary. The lower knife speeds are desirable. Double-bevel and single-bevel knives, *Fig.* 6, can be used on single or stacked sheets.

The fluorocarbons and nylon can be die cut or stamped. Small, flat nylon parts such as washers, grommets and nonprecision gears, $\frac{1}{16}$ inch or less in thickness, can often be produced more economically by punching or stamping from extruded strip than by injection molding. Conventional dies are used in regular punch presses. With well-made dies, nylon can be blanked or punched cleanly at high speed. If cracking occurs, it can usually be overcome by soaking the strip in water or preheating.

Photo courtesy Cadillac Plastic & Chemical Co.

Fig. 5. (above) Template is traced on acetate sheet with a scoring knife and is then snapped out by bending the sheet. Rigid templates in intricate shapes can easily be prepared in this way.

Fig. 6. (right) Rigid vinyl sheets can be successfully cut with either of these blade designs.

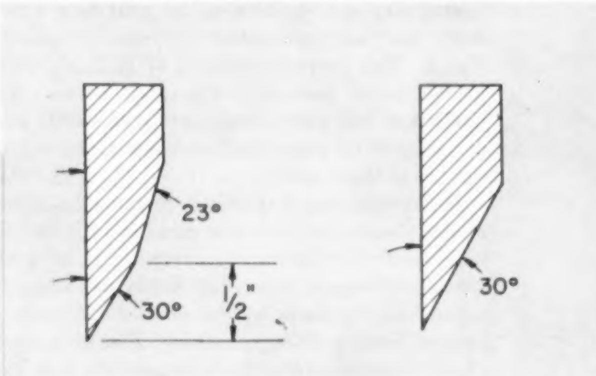
Experience is an important factor when punching laminated plastics. There are grades for punching hot, *Fig.* 7, and others for punching cold, TABLE 2. Punching can be done on standard vertical punch presses. Progressive, compound and multiple operation dies, including combination blanking and shaving, can be used. Punching dies are almost the same as those used for sheet metal except minimum clearances are maintained between punch and die, and punch and stripper plate. The latter is necessary to prevent lifting material around holes when the punches are withdrawn. The stripper should be backed by strong springs.

When designing dies for hot punching, allowance must be made for shrinkage. Increase in size depends on the size of the hole, grade and thickness of laminate, and punching temperature. Relatively smooth edges can be obtained when punching hot in thicknesses up to $\frac{1}{16}$ inch. Checking occurs in thicker pieces. The best edges are obtained with fabric-base materials. For good edges on thicknesses over $\frac{1}{16}$ inch, shaving should be used with oversize blanks. Combination punching, blanking and shaving dies can be used for material up to $\frac{1}{8}$ inch thick.

As a separate process, shaving can be used cold on pieces up to $\frac{1}{8}$ inch thick and hot on thickness to $\frac{3}{4}$ inch. Laminates are normally heated to between 120 and 250 F. None of the grades should be heated to more than 275 F since they will blister and the gloss finish will disappear.

Minimum clearance between individual punch-

Drawing courtesy Bakelite Div. Union Carbide and Carbon Corp.



ings and between punchings and the edge is 1.5 times the sheet thickness. If clearance is any less, the force of the punch may crack the laminate between the holes. The diameter of a punched hole should never be less than the thickness of the sheet. The main danger here is the possibility of breaking smaller punches. Sharp outside corners are subject to cavitation when punched. Punching fractures extend for a distance approximately equal to ⅓ of the material thickness from the punched edge, varying slightly with grade and die clearance. Piece may be punched large with the fractures removed by shaving, or a rounded-corner design may be substituted.

With laminates, the amount of compression produced by shearing is important. If the core is soft or brittle, it can be pinched out by the compression between the top and bottom shear blades. There is more compression when the slope of the top blade is reduced. By acutely bevelling the top blade, this condition can be lessened. Before starting a shearing run it is a good idea to determine the best shear speed, blade angle and shear pressure by test.

Standard sheet-metal shears can be used for shearing laminates. The material should be securely held. Most paper-base laminates can be sheared in thicknesses up to 1/16 inch and most canvas-base laminates in thicknesses to ⅛ inch at room temperature, TABLE 2. Thicker and harder stocks should be heated uniformly. Gang rotary shears can be used for slitting thin laminated plastics sheets.

Glass, asbestos and graphite-filled laminates can be punched and sheared. Only thin sheets should be punched, and then only with carbide tools, but shearing can be done in thicknesses up to 1/16 inch after uniform heating.

Turning and Facing: Standard machines can be used for most plastics turning operations, *Fig.* 1. Tool geometries, feeds and speeds vary according to the type of plastic being turned, but one general rule applies to the turning of all plastics. To obtain good surface finishes, tools must be sharp.

Acrylics, for example, can be turned with an excellent semimatte finish on standard engine lathes, *Fig.* 8. Cutting tools should have a zero or slightly negative rake and should be positioned at or just below the center line of the part. Acrylic parts up to 2.5 inches in diameter should be turned at speeds from 700 to 800 rpm. For larger diameters, surface speeds of 500 sfpm with feeds of 0.004 to 0.005 ipr will result in clean, continuous chips. Heavy feeds and deep cuts are not recommended because an attempt to remove too much material with one cut

Photo courtesy Westinghouse Electric Corp.

Fig. 7. Lightweight fan blades can be punched hot from laminated plastic sheet.

will result in chipping, chattering or other damage to the workpiece.

Cast phenolic parts can be turned with tools sharpened in the same way as those for brass. A clearance of 10 to 20 deg and a slightly negative or zero rake are desirable. Special tool materials are not usually required. Hard bronze tools can be used for short runs. It is more economical to use carbon, high-speed or high-alloy steel, or carbide tools for long runs. A satisfactory turning speed is 600 sfpm.

High-speed steel tools are used when turning small lots of molded phenolic parts. Cutting speed varies from 100 to 150 sfpm. High-alloy tools can be used at speeds between 200 and 300 sfpm and tungsten carbide tools can be used at speeds between 300 and 400 sfpm. Tools are commonly given a slight negative back rake and a clearance angle of

about 8 deg. Air blasts can be used to advantage.

Lathe work on polystyrene is comparatively easy. Fairly slow speeds should be used, although speed may be increased in direct ratio to the effectiveness of cooling. Sharp high-speed steel or carbide tools with slight rakes and large clearances permit a maximum depth of cut. Dry cutting speeds of 100 to 200 sfpm are satisfactory if vibration is prevented. Preventing vibration is especially important when turning long, slender pieces. For best results, the tool and cutting operation are adjusted to give a straight ribbon shaving. Geometry of a general-purpose tool for turning polystyrene is shown on *Fig. 9*. Back rake may be slightly greater than shown and it may be necessary to set the tool slightly higher to minimize climbing and chatter tendencies.

Table 2—Shearing Thicknesses for Laminated Plastics

NEMA Grade	Maximum Shearing Thickness Cold (inch)	Hot (inch)
X	1/32	⅛
P	1/16	3/16
PC	3/32	¼
XX	1/32	⅛
XXP	1/16	3/16
XXX	1/32	⅛
XXXP	1/32	⅛
C	1/16	⅛
CE	1/32	⅛
L	1/32	⅛
LE	1/32	⅛
A	1/32	⅛
AA	1/16	⅛
G-5	1/32	1/16

The amount the tool can be raised above the center line is limited by the effective back rake (angle above center minus back rake angle), which should be zero or slightly negative for best results.

Power feeds of 0.020 to 0.030 inch with depths of cut to 0.10 inch are satisfactory for roughing polystyrene and result in tightly curled chips. Finish cuts are best made with 0.005 to 0.020-inch feed and up to 0.030-inch depths of cut. When finishing cuts are made with a large-radius tool and a coolant, continuous chips are formed. Since the torque required to cut polystyrene is low, various collet and rubber mounting methods can be devised to protect the part from damage during clamping.

A slight radius, 1/32 inch, on the nose of the turning tool will permit heavier cuts in cross-linked polystyrene. Clearance angles should be less than those used for most plastics. This setup prevents the tool from digging into the work and chipping out material. A slight negative rake is good and the use of a light lubricating or cutting oil will help produce a lustrous finish. General turning can be done at 300 to 400 sfpm; production turning speeds can be as high as 600 to 700 sfpm. A typical tool for turning cross-linked polystyrene has a front clearance from 10 to 15 deg, side clearance of 2 to 4 deg and rake of 0 to -2 deg.

Modified styrenes can be turned on regular metal-cutting lathes but, to prevent distortion, workpieces should be held with minimum practicable pressures. If the part can be held in a collet, the chances for

Photo courtesy Cadillac Plastic & Chemical Co.

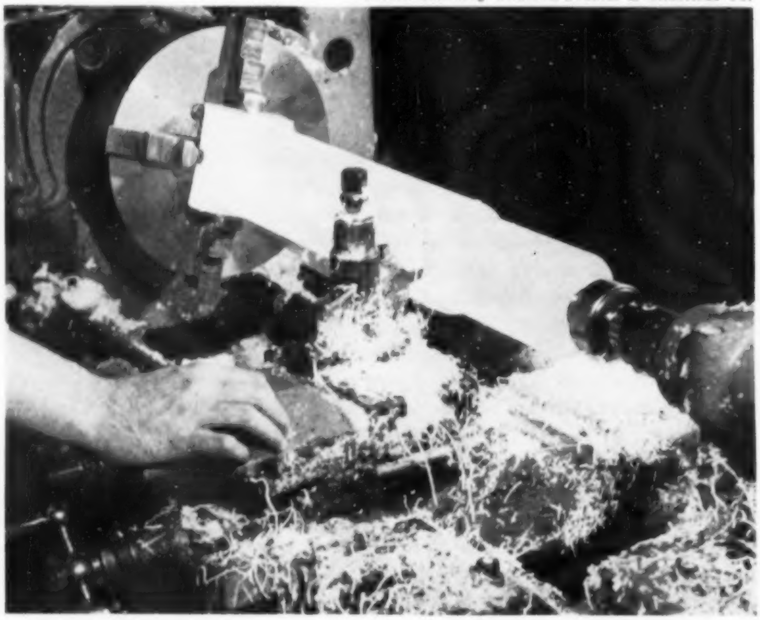


Fig. 8. Acrylic cylinder is turned from the solid in several cuts. A light finishing cut will result in a semimatte surface.

overstressing the part are lessened. Live centers should be used since stationary centers generate excessive heat. Carbide-tipped tools with large clearances and slight negative rake are used. A general-purpose turning tool might have a negative rake of -5 deg, front and side clearances of about 10 deg and side rake of about 10 deg. With the cutting edge set slightly above center, chatter is reduced.

Turning, facing and boring of parts made from rigid vinyl sheet can be done with most metal-cutting tools, provided front and side clearances are increased about 50 percent over those used to machine steel. Added clearances reduce the rate of heat formation, and produce good surface finishes and free-flowing chips. An increase in rake angle, made by hollow grinding the tool cutting face, offers some advantages in directing the chip away from the work. However, the accompanying reduction of cutting angle results in greater tool wear.

Speeds between 250 and 300 sfpm permit depths of cut as high as 0.25 inch and feed rates up to 12 ipm. Higher speeds and feeds can be used with lighter cuts. Cutoff tools for rigid vinyl should also be ground with increased front and side clearances. Speed for cutting off should be half of that used for turning. Slower speeds tend to rough the cut surface and faster speeds would cause overheating.

Nylon can be turned easily on metalworking lathes, *Fig.* 10 and high turning speeds with fine feeds result in a smooth finish. Pointed tools should be avoided when machining soft nylon because they will scratch the work and leave shavings attached to the surface. A slight radius on the cutting tip will prevent this. Bits should be ground as for yellow brass or bronze and should have minimum drag. A typical single-point tool is shown in *Fig.* 11.

Roughing cuts are not necessary with nylon. Carbide tools are used for long runs and tool life can be extended by careful honing on a fine diamond wheel. Carbide tools for hard nylon would be operated at 750 to 900 sfpm and having the following geometry: side clearance, 5 to 15 deg; front clearance, 20 to 30 deg; and zero back and side rake. Carbide tools for soft nylon are operated at 500 sfpm and have the same geometry as those for hard except that side clearances are from 15 to 20 deg.

Since nylon tends to produce a continuous chip, which may wrap around the work or the tool post, a chip breaker should be ground on the tool. Otherwise, it may be necessary to cut the chip loose at the end of each pass. In some instances, ground chip breakers have not worked but pick-offs can be used as an aid in separating turnings.

To prevent difficulties resulting from the flexibility of nylon, turning can be done with box tools. Tangent type box tools, with either roller or V-rests, work well. The cutter is set slightly below center,

Data courtesy The Dow Chemical Co.

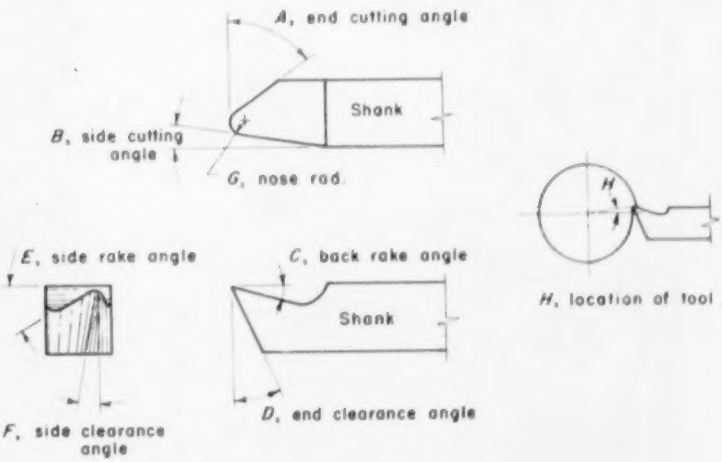


Fig. 9. Typical general-purpose lathe tool for use with polystyrene compared with the geometry of a tool for cutting medium steel.

Material	A	B	C	D	E	F	G	H
Medium Steel	20°	10°	+8°	6°	14°	4°	3/16	0°
Polystyrene	20°	10°	−2°	12°	10°	10°	3/16	+2°

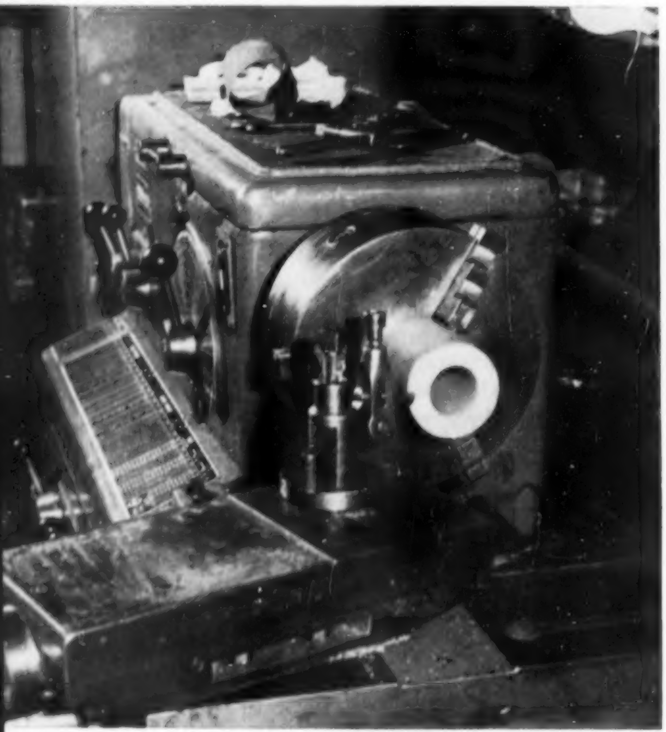


Photo courtesy Cadillac Plastic & Chemical Co.

is ground to a radius and has a positive rake of 0 to 5 deg. Forming tools can be used advantageously because little pressure is needed to remove large cross sections. Plunge forming is possible if the cutting surface of the tool is no wider than the diameter of the work at its smallest cross section. Deflection must be prevented if longer cuts are required. Both circular and dovetail form tools can be used. For such tools, front clearances range from 10 to 15 deg and negative top rake varies from -1 to -3 deg. The feed rate depends on the amount of deflection when forming but usually lies between 0.004 and 0.010 ipr. For automatic screw machine work on nylon, serrated cams are good because they momentarily stop the feed and help to break the stringy chips. Reduced feed at the end of tool travel helps to obtain a clean and accurate surface.

Blade type cutoff tools can be used for cutting both hard and soft grades of nylon. Larger clearances should be used with the softer grade to provide for greater chip removal. Tools should be set square and on center, especially when parting hard nylon, to insure straight cuts and prevent excessive

Fig. 10. (left) Satisfactory setup for the turning of a nylon bushing.

Drawing courtesy The Polymer Corp. of Pennsylvania

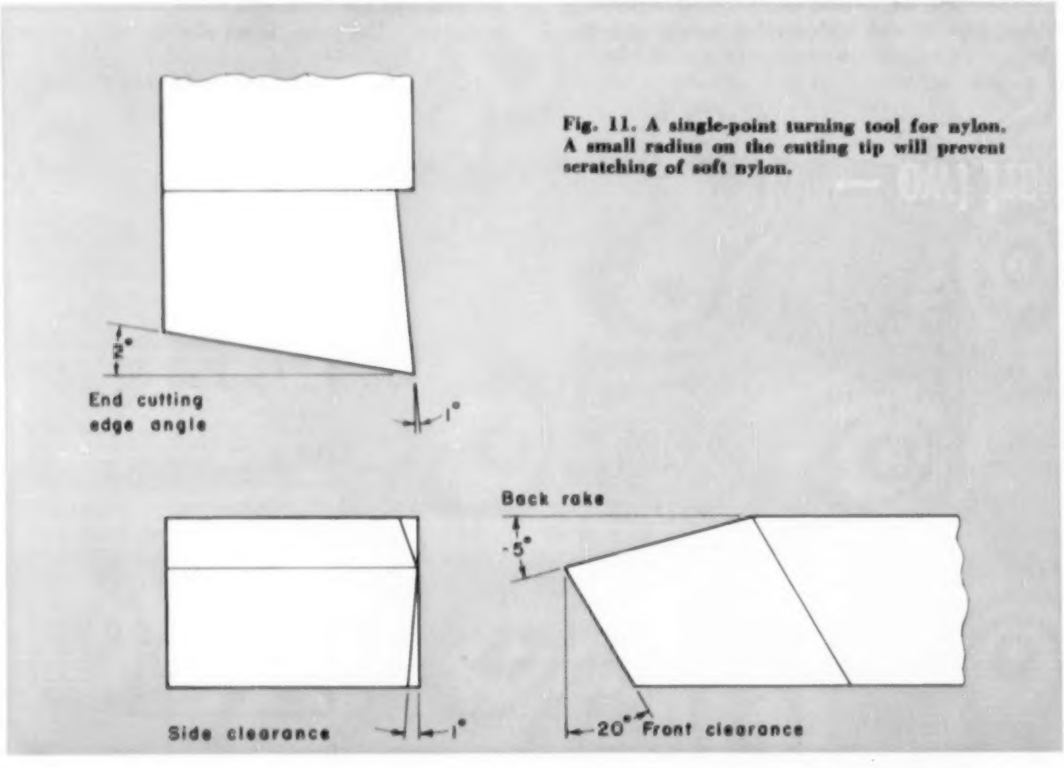


Fig. 11. A single-point turning tool for nylon. A small radius on the cutting tip will prevent scratching of soft nylon.

burrs. The cut surface has a better finish if the tool overhang is kept to a minimum. Coolant should be used and the cutoff tool should have zero or negative back rake. The slight burr that usually forms at entry of the cutoff tool can be prevented by preparing the work with a chamfer first. Dull cutters will form burrs at the end of the cut. Cutoff feed varies between 0.002 and 0.010 ipr.

Fluorocarbon polymers are turned with approximately the same tooling and procedures as used for turning nylon. Turning speeds vary from 250 to 1200 rpm. Bull nose tools and right-hand corner tools can be used successfully. Cuts as deep as 0.250 inch have been taken in one pass.

Operations on laminated plastics are similar to those on brass except that feeds and speeds are higher. Cutting speeds vary from 400 sfpm for roughing cuts with high-speed steel tools to 2500 sfpm for finishing with carbides. Turret lathes are usually run at their top speed for most jobs within their capacity. About 0.010 inch of stock should be left for finishing cuts on laminates.

Forming and undercutting can successfully be performed but care must be taken that fine feeds are used, preferably not over 0.001 ipr. Circular and square tools can be used for forming but should not be greater in width than 75 percent of the diameter of the stock. For both threading and forming, tools should be ground with from 0 to -10 deg negative rake.

Most turret lathe, *Fig.* 12, and screw machine work on laminated plastics is done dry. When threading or drilling deep holes, lard oil and kerosene or paraffin oil and kerosene cutting fluids are used. High-speed steel tools can be used for finishing all but the hard-to-machine (glass, asbestos and graphite) laminates. Carbide tools wear longer with all laminates and are usually used on paper-base grades. Tools are similar in design to those used for turning brass.

The usual tool has 10 to 12 deg of side clearance and several degrees more take than when cutting metal. Sharp tools with a flat lip are good but round-nose tools give an even better finish. To achieve a polished surface, it is possible to cut with a tool having as little clearance as possible. The heel of the tool thus burnishes the surface. This technique is especially good when facing parallel with the laminations.

Glass, asbestos and graphite laminates are turned at slow speeds. Use of a coolant is desirable but not necessary. If a coolant is not used, cutting speed

Photo courtesy Westinghouse Electric Corp.

Fig. 12. Laminated plastic pressure cylinder seal ring being machined on a vertical turret lathe.

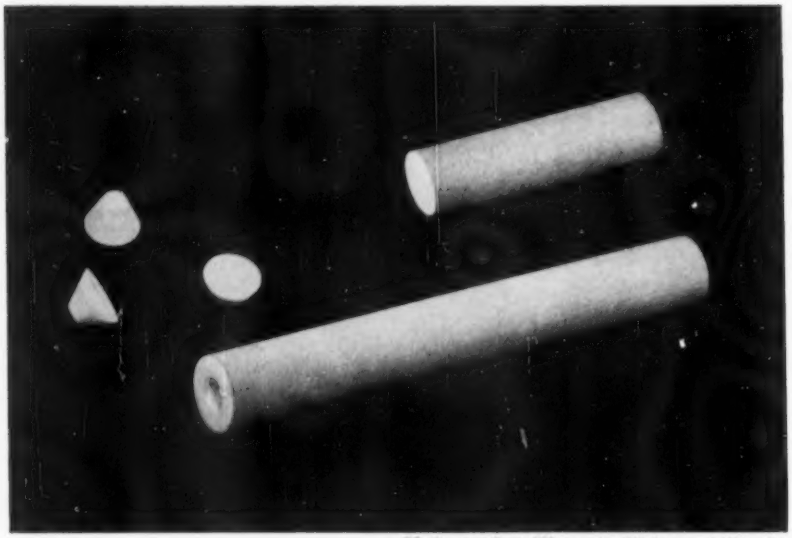


Photo courtesy Minnesota Mining and Mfg. Co.

Fig. 13. Glass-reinforced epoxy parts can be turned by handling them as if they were hard, grained wood.

should not exceed 200 sfpm. Diamond and tungsten carbide turning and boring tools are used exclusively.

Glass-reinforced epoxy plastics, *Fig.* 13, are turned with carbide tools. These tools have the same clearances, rake angles, etc., as those used for turning hard, grained wood. A rounded, rather than a sharp pointed, bit gives best results. Machining methods are similar to those used for cast iron. High speeds and medium feeds work satisfactorily. As an alternate method, the heel of the tool can be fed into the work at a high speed and with a heavy feed.

Because the resiliency of plastics is less at reduced temperatures, some plastic parts are chilled before turning and boring. When working on chilled plastics, it is important that feed be kept continuous and steady. If the cutter is stopped in the middle of a pass, the work will be noticeably marked. Screw machine work on thermoplastic rod stock is done at about 1400 rpm.

Single-point tools used on chilled plastics should be V-shaped. As a starting point, the tool geometry should be: clearances, about 20 to 25 deg; side rake, 30 deg; and tip radius, 5/32 inch. For polystyrene, clearances can be as little as 10 deg and the tool should have a negative top rake of -2 deg. For other thermoplastics, the rake should be about zero or just slightly negative.

Tools are generally mounted at or slightly below the center line of the part. Where the plastic has a tendency to force the tool downward, this effect can be offset by mounting the tool point a few thousandths above the center line of the work.

When high-speed steel tools are used on chilled plastics, cutting speed should range between 250 and 300 sfpm; with carbides, the speed should be about 500 sfpm. For slow speeds, a feed of about 0.012 ipr can be used. When turning at higher speeds, especially recommended for acrylics, the feed should be cut to about 0.005 ipr.

Plastics can be worked by most of the machining processes that are applied to metals. Although the data presented on turning plastics indicate the techniques to be used in the other machining processes, specific data will be given in a future article.

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Transition and Interference Fits

for holes and shafts

FITS have been classified into five types. These are:

- RC Running or sliding fits
- LC Clearance locational fits
- LT Transition fits
- LN Interference locational fits
- FN Force or shrink fits

Limits for the two types of clearance fits, running or sliding fits and clearance locational fits, were published in THE TOOL ENGINEER, Sept., 1956. Limits for other types of fits are included in this reference sheet. In specifying all fits listed, the basic size of mating parts is chosen from sizes given in TABLE 1. All fundamental tolerances and allowances of shafts

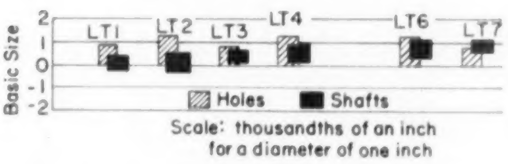


Fig. 1. Graphical representation of standard transition fits shown in Table 3.

Extracted from American Standard Preferred Limits and Fits for Cylindrical Parts (ASA B4.1-1955) with the permission of the publisher, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

Table 1—Preferred Basic Sizes*

...	0.0100	
	0.0125	
1/64	0.015625	
...	0.0200	
	0.0250	
1/32	0.03125	
	0.0400	0.04
	0.0500	
		0.06
1/16	0.0625	
	0.0800	...
3/32	0.09375	...
...	0.1000	0.10
1/8	0.1250	
	...	0.15
5/32	0.15625	
3/16	0.1875	
	...	0.20
1/4	0.2500	0.25
		0.30
5/16	0.3125	
	...	0.35
3/8	0.3750	
		0.40
7/16	0.4375	
1/2	0.5000	0.50
9/16	0.5625	
		0.60
5/8	0.6250	
11/16	0.6875	
		0.70
3/4	0.7500	0.75
		0.80
7/8	0.8750	
		0.90
1	1.0000	1.0
		1.1
1⅛	1.1250	
1¼	1.2500	1.25
1⅜	1.3750	
		1.40
1½	1.5000	1.50
1⅝	1.6250	
1¾	1.7500	1.75
1⅞	1.8750	
2	2.0000	2.0
2⅛	2.1250	
2¼	2.2500	2.25
2⅜	2.3750	
2½	2.5000	2.5
2⅝	2.6250	
2¾	2.7500	2.75
2⅞	2.8750	
3	3.0000	3.0
3¼	3.2500	3.25
3½	3.5000	3.5
3¾	3.7500	3.75
4	4.0000	4.0
4¼	4.2500	4.25
4½	4.5000	4.5
4¾	4.7500	4.75
5	5.0000	5.0
5¼	5.2500	5.25
5½	5.5000	5.5
5¾	5.7500	5.75
6	6.0000	6.0
6½	6.5000	6.5
7	7.0000	7.0
7½	7.5000	7.5
8	8.0000	8.0
8½	8.5000	8.5
9	9.0000	9.0
9½	9.5000	9.5
10	10.0000	10.0
10½	10.5000	10.5
11	11.0000	11.0
11½	11.5000	11.5
12	12.0000	12.0
12½	12.5000	12.5
13	13.0000	13.0
13½	13.5000	13.5
14	14.0000	14.0
14½	14.5000	14.5
15	15.0000	15.0
15½	15.5000	15.5
16	16.0000	16.0
16½	16.5000	16.5
17	17.0000	17.0
17½	17.5000	17.5
18	18.0000	18.0
18½	18.5000	18.5
19	19.0000	19.0
19½	19.5000	19.5
20	20.0000	20.0
20½	20.5000	
21	21.0000	

*All dimensions given in inches

Table 2—Preferred Series for Tolerances and Allowances*

0.1 0.15 0.2 0.25 0.3 0.4 0.5 0.6 0.7 0.8 0.9	1 1.2 1.4 1.6 1.8 2 2.2 2.5 2.8 3 3.5 4 4.5 5 6 7 8 9	10 12 14 16 18 20 22 25 28 30 35 40 45 50 60

*All dimensions given in thousandths of an inch.

and holes are taken from the series given in TABLE 2.

Transition fits, *Fig.* 1, are a compromise between clearance and interference fits, for applications where accuracy of location is important, but a small amount of clearance or interference is permissible. Interference locational fits, *Fig.* 2, are used where accuracy of location is of prime importance and for parts requiring rigidity and alignment with no special requirements for bore pressure. Such fits are not intended for parts designed to transmit frictional

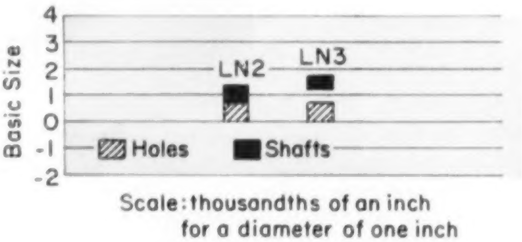


Fig. 2. (right) Graphical representation of standard interference locational fits shown in Table 4.

Table 3—Transition Locational Fits*

Nominal Size Range (inches) Over To	Class LT 1 Fit	Class LT 1 Hole	Class LT 1 Shaft	Class LT 2 Fit	Class LT 2 Hole	Class LT 2 Shaft	Class LT 3 Fit	Class LT 3 Hole	Class LT 3 Shaft	Class LT 4 Fit	Class LT 4 Hole	Class LT 4 Shaft	Class LT 6 Fit	Class LT 6 Hole	Class LT 6 Shaft	Class LT 7 Fit	Class LT 7 Hole	Class LT 7 Shaft
0.04- 0.12	−0.15 +0.5	+0.4 −0	+0.15 −0.1	−0.3 +0.7	+0.6 −0	+0.3 −0.1							−0.55 +0.45	+0.6 −0	+0.55 +0.15	−0.5 +0.15	+0.4 −0	+0.5 +0.25
0.12- 0.24	−0.2 +0.6	+0.5 −0	+0.2 −0.1	−0.4 +0.8	+0.7 −0	+0.4 −0.1							−0.7 +0.5	+0.7 −0	+0.7 +0.2	−0.6 +0.2	+0.5 −0	+0.6 +0.3
0.24- 0.40	−0.3 +0.7	+0.6 −0	+0.3 −0.1	−0.4 +1.1	+0.9 −0	+0.4 −0.2	−0.5 +0.5	+0.6 −0	+0.5 +0.1	−0.7 +0.8	+0.9 −0	+0.7 +0.1	−0.8 +0.7	+0.9 −0	+0.8 +0.2	−0.8 +0.2	+0.6 −0	+0.8 +0.4
0.40- 0.71	−0.3 +0.8	+0.7 −0	+0.3 −0.1	−0.5 +1.2	+1.0 −0	+0.5 −0.2	−0.5 +0.6	+0.7 −0	+0.5 +0.1	−0.8 +0.9	+1.0 −0	+0.8 +0.1	−1.0 +0.7	+1.0 −0	+1.0 +0.3	−0.9 +0.2	+0.7 −0	+0.9 +0.5
0.71- 1.19	−0.3 +1.0	+0.8 −0	+0.3 −0.2	−0.5 +1.5	+1.2 −0	+0.5 −0.3	−0.6 +0.7	+0.8 −0	+0.6 +0.1	−0.9 +1.1	+1.2 −0	+0.9 +0.1	−1.1 +0.9	+1.2 −0	+1.1 +0.3	−1.1 +0.2	+0.8 −0	+1.1 +0.6
1.19- 1.97	−0.4 +1.2	+1.0 −0	+0.4 −0.2	−0.6 +2.0	+1.6 −0	+0.6 −0.4	+0.7 +0.9	+1.0 −0	+0.7 +0.1	−1.1 +1.5	+1.6 −0	+1.1 +0.1	−1.4 +1.2	+1.6 −0	+1.4 +0.4	−1.3 +0.3	+1.0 −0	+1.3 +0.7
1.97- 3.15	−0.4 +1.5	+1.2 −0	+0.4 −0.3	−0.7 +2.3	+1.8 −0	+0.7 −0.5	−0.8 +1.1	+1.2 −0	+0.8 +0.1	−1.3 +1.7	+1.8 −0	+1.3 +0.1	−1.7 +1.3	+1.8 −0	+1.7 +0.5	−1.5 +0.4	+1.2 −0	+1.5 +0.8
3.15- 4.73	−0.5 +1.8	+1.4 −0	+0.5 −0.4	−0.8 +2.8	+2.2 −0	+0.8 −0.6	−1.0 +1.3	+1.4 −0	+1.0 +0.1	−1.5 +2.1	+2.2 −0	+1.5 +0.1	−1.9 +1.7	+2.2 −0	+1.9 +0.5	−1.9 +0.4	+1.4 −0	+1.9 +1.0
4.73- 7.09	−0.6 +2.0	+1.6 −0	+0.6 −0.4	−0.9 +3.2	+2.5 −0	+0.9 −0.7	−1.1 +1.5	+1.6 −0	+1.1 +0.1	−1.7 +2.4	+2.5 −0	+1.7 +0.1	+2.2 +1.9	+2.5 −0	+2.2 +0.6	−2.2 +0.4	+1.6 −0	+2.2 +1.2
7.09- 9.85	−0.7 +2.3	+1.8 −0	+0.7 −0.5	−1.0 +3.6	+2.8 −0	+1.0 −0.8	−1.4 +1.6	+1.8 −0	+1.4 +0.2	−2.0 +2.6	+2.8 −0	+2.0 +0.2	−2.4 +2.2	+2.8 −0	+2.4 +0.6	−2.6 +0.4	+1.8 −0	+2.6 +1.4
9.85-12.41	−0.7 +2.6	+2.0 −0	+0.7 −0.6	−1.0 +4.0	+3.0 −0	+1.0 −1.0	−1.4 +1.8	+2.0 −0	+1.4 +0.2	−2.2 +2.8	+3.0 −0	+2.2 +0.2	−2.8 +2.2	+3.0 −0	+2.8 +0.8	−2.6 +0.6	+2.0 −0	+2.6 +1.4
12.41-15.75	−0.7 +2.9	+2.2 −0	+0.7 −0.7	−1.0 +4.7	+3.5 −0	+1.2 −1.0	−1.6 +2.0	+2.2 −0	+1.6 +0.2	−2.4 +3.3	+3.5 −0	+2.4 +0.2	−3.0 +2.7	+3.5 −0	+3.0 +0.8	−3.0 +0.6	+2.2 −0	+3.0 +1.6
15.75-19.69	−0.8 +3.2	+2.5 −0	+0.8 −0.7	−1.3 +5.2	+4.0 −0	+1.3 −1.2	−1.8 +2.3	+2.5 −0	+1.8 +0.2	−2.7 +3.8	+4.0 −0	+2.7 +0.2	−3.4 +3.1	+4.0 −0	+3.4 +0.9	−3.4 +0.7	+2.5 −0	+3.4 +1.8

*All fits and limits are in thousandths of an inch. Limits for holes and shafts are applied algebraically to the basic size to obtain the limits of size for the parts.

loads from one part to another by virtue of the tightness of fit, as these conditions are covered by force fits.

Force or shrink fits, *Fig.* 3, constitute a special type of interference fit, normally characterized by maintenance of constant bore pressures throughout the range of sizes. The interference therefore varies almost directly with diameter, and the difference between its maximum and minimum value is small, to maintain the resulting pressures within reasonable limits. These fits may be briefly described as follows:

> LIGHT DRIVE FITS, FN 1, require light assembly pressures and produce more or less permanent assemblies. They are suitable for thin sections or long fits, or in cast-iron external members.
>
> MEDIUM DRIVE FITS, FN 2, are suitable for ordinary steel parts, or for shrink fits on light sections. They are the tightest fits that can be used with high-grade cast-iron external members.
>
> HEAVY DRIVE FITS, FN 3, are used for heavier steel parts or for shrink fits in medium sections.
>
> FORCE FITS, FN 4 and FN 5, are specified for parts which can be highly stressed or for shrink fits where the heavy pressing forces required are impractical.

Limits for the LT, LN and FN types of fits described are contained in TABLES 3, 4 and 5.

Table 4—Interference Locational Fits*

Nominal Size Range (inches)	Class LN 2			Class LN 3		
	Limits of Interference	Standard Limits		Limits of Interference	Standard Limits	
Over To		Hole	Shaft		Hole	Shaft
0.04- 0.12	0 0.65	+0.4 − 0	+0.65 +0.4	0.1 0.75	+0.4 0	+ 0.75 + 0.5
0.12- 0.24	0 0.8	+0.5 − 0	+0.8 +0.5	0.1 0.9	+0.5 0	+ 0.9 + 0.6
0.24- 0.40	0 1.0	+0.6 − 0	+1.0 +0.6	0.2 1.2	+0.6 − 0	+ 1.2 + 0.8
0.40- 0.71	0 1.1	+0.7 − 0	+1.1 +0.7	0.3 1.4	+0.7 − 0	+ 1.4 + 1.0
0.71- 1.19	0 1.3	+0.8 − 0	+1.3 +0.8	0.4 1.7	+0.8 − 0	+ 1.7 + 1.2
1.19- 1.97	0 1.6	+1.0 − 0	+1.6 +1.0	0.4 2.0	+1.0 − 0	+ 2.0 + 1.4
1.97- 3.15	0.2 2.1	+1.2 − 0	+2.1 +1.4	0.4 2.3	+1.2 − 0	+ 2.3 + 1.6
3.15- 4.73	0.2 2.5	+1.4 − 0	+2.5 +1.6	0.6 2.9	+1.4 − 0	+ 2.9 + 2.0
4.73- 7.09	0.2 2.8	+1.6 − 0	+2.8 +1.8	0.9 3.5	+1.6 − 0	+ 3.5 + 2.5
7.09- 9.85	0.2 3.2	+1.8 − 0	+3.2 +2.0	1.2 4.2	+1.8 − 0	+ 4.2 + 3.0
9.85-12.41	0.2 3.4	+2.0 − 0	+3.4 +2.2	1.5 4.7	+2.0 − 0	+ 4.7 + 3.5
12.41-15.75	0.3 3.9	+2.2 − 0	+3.9 +2.5	2.3 5.9	+2.2 − 0	+ 5.9 + 4.5
15.75-19.69	0.3 4.4	+2.5 − 0	+4.4 +2.8	2.5 6.6	+2.5 − 0	+ 6.6 + 5.0
19.69-30.09	0.5 5.5	+3 − 0	+5.5 +3.5	4 9	+3 − 0	+ 9 + 7
30.09-41.49	0.5 7.0	+4 − 0	+7.0 +4.5	5 11.5	+4 − 0	+11.5 + 9
41.49-56.19	1 9	+5 − 0	+9 +6	7 15	+5 − 0	+15 +12

*All interferences and limits are in thousandths of an inch. Limits for holes and shafts are applied algebraically to the basic size to obtain the limits of size for the parts.

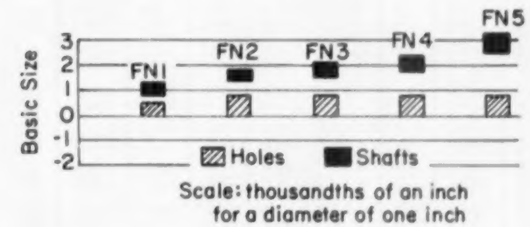
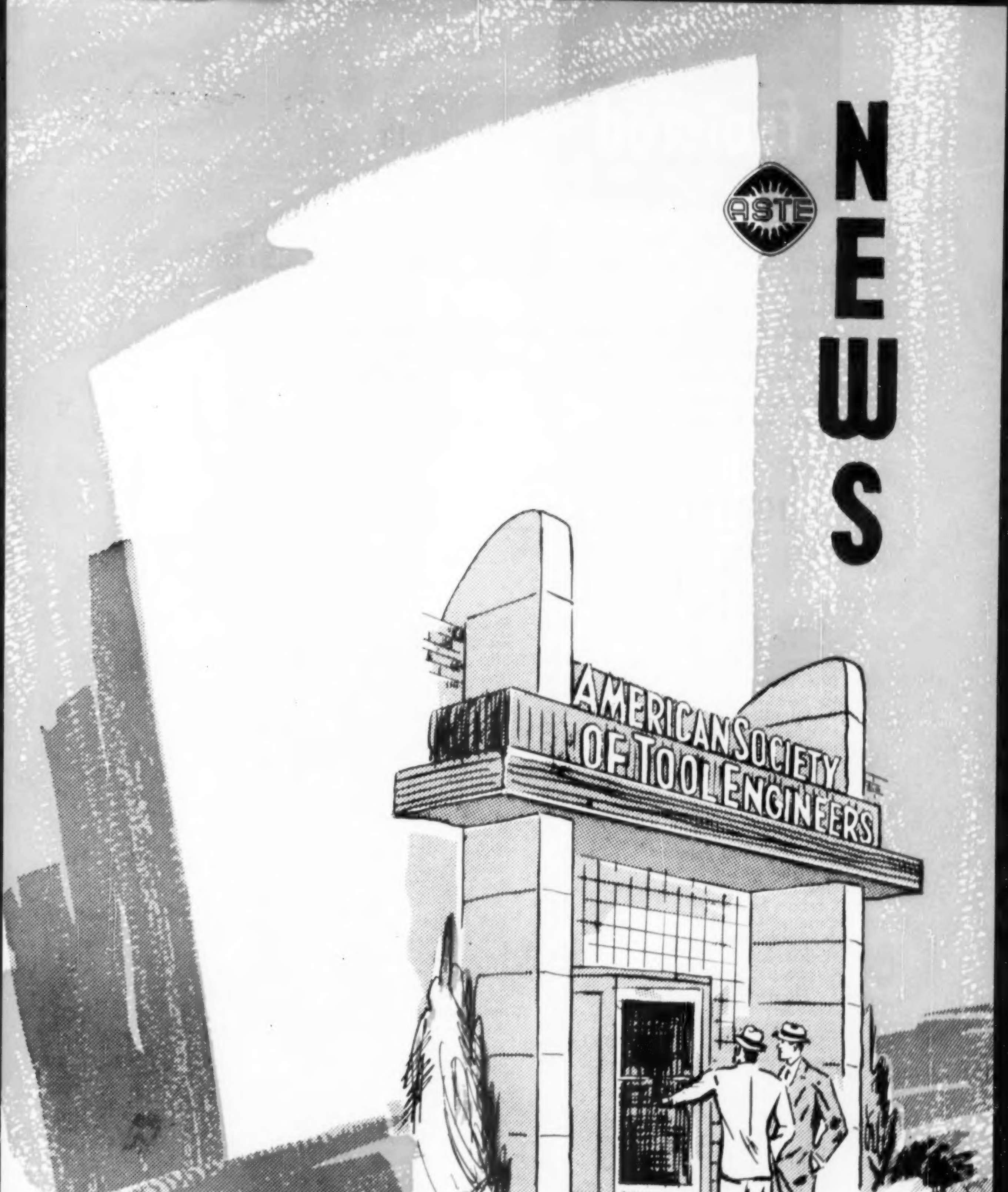


Fig. 3. Graphical representation of standard force or shrink fits shown in TABLE 5.

Table 5—Force and Shrink Fits*

Nominal Size Range (inches)	Class FN 1			Class FN 2			Class FN 3			Class FN 4			Class FN 5		
	Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits	
Over To		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft
0.04- 0.12	0.05 0.5	+0.25 — 0	+ 0.5 + 0.3	0.2 0.85	+0.4 — 0	+ 0.85 + 0.6				0.3 0.95	+0.4 — 0	+ 0.95 + 0.7	0.5 1.3	+0.4 — 0	+ 1.3 + 0.9
0.12- 0.24	0.1 0.6	+0.3 — 0	+ 0.6 + 0.4	0.2 1.0	+0.5 — 0	+ 1.0 + 0.7				0.4 1.2	+0.5 — 0	+ 1.2 + 0.9	0.7 1.7	+0.5 — 0	+ 1.7 + 1.2
0.24- 0.40	0.1 0.75	+0.4 — 0	+ 0.75 + 0.5	0.4 1.4	+0.6 — 0	+ 1.4 + 1.0				0.6 1.6	+0.6 — 0	+ 1.6 + 1.2	0.8 2.0	+0.6 — 0	+ 2.0 + 1.4
0.40- 0.56	0.1 0.8	+0.4 — 0	+ 0.8 + 0.5	0.5 1.6	+0.7 — 0	+ 1.6 + 1.2				0.7 1.8	+0.7 — 0	+ 1.8 + 1.4	0.9 2.3	+0.7 — 0	+ 2.3 + 1.6
0.56- 0.71	0.2 0.9	+0.4 — 0	+ 0.9 + 0.6	0.5 1.6	+0.7 — 0	+ 1.6 + 1.2				0.7 1.8	+0.7 — 0	+ 1.8 + 1.4	1.1 2.5	+0.7 — 0	+ 2.5 + 1.8
0.71- 0.95	0.2 1.1	+0.5 — 0	+ 1.1 + 0.7	0.6 1.9	+0.8 — 0	+ 1.9 + 1.4				0.8 2.1	+0.8 — 0	+ 2.1 + 1.6	1.4 3.0	+0.8 — 0	+ 3.0 + 2.2
0.95- 1.19	0.3 1.2	+0.5 — 0	+ 1.2 + 0.8	0.6 1.9	+0.8 — 0	+ 1.9 + 1.4	0.8 2.1	+0.8 — 0	+ 2.1 + 1.6	1.0 2.3	+0.8 — 0	+ 2.3 + 1.8	1.7 3.3	+0.8 — 0	+ 3.3 + 2.5
1.19- 1.58	0.3 1.3	+0.6 — 0	+ 1.3 + 0.9	0.8 2.4	+1.0 — 0	+ 2.4 + 1.8	0.8 2.4	+1.0 — 0	+ 2.6 + 2.0	1.5 3.1	+1.0 — 0	+ 3.1 + 2.5	2.0 4.0	+1.0 — 0	+ 4.0 + 3.0
1.58- 1.97	0.4 1.4	+0.6 — 0	+ 1.4 + 1.0	0.8 2.4	+1.0 — 0	+ 2.4 + 1.8	1.2 2.8	+1.0 — 0	+ 2.8 + 2.2	1.8 3.4	+1.0 — 0	+ 3.4 + 2.8	3.0 5.0	+1.0 — 0	+ 5.0 + 4.0
1.97- 2.56	0.6 1.8	+0.7 — 0	+ 1.8 + 1.3	0.8 2.7	+1.2 — 0	+ 2.7 + 2.0	1.3 3.2	+1.2 — 0	+ 3.2 + 2.5	2.3 4.2	+1.2 — 0	+ 4.2 + 3.5	3.8 6.2	+1.2 — 0	+ 6.2 + 5.0
2.56- 3.15	0.7 1.9	+0.7 — 0	+ 1.9 + 1.4	1.0 2.9	+1.2 — 0	+ 2.9 + 2.2	1.8 3.7	+1.2 — 0	+ 3.7 + 3.0	2.8 4.7	+1.2 — 0	+ 4.7 + 4.0	4.8 7.2	+1.2 — 0	+ 7.2 + 6.0
3.15- 3.94	0.9 2.4	+0.9 — 0	+ 2.4 + 1.8	1.4 3.7	+1.4 — 0	+ 3.7 + 2.8	2.1 4.4	+1.4 — 0	+ 4.4 + 3.5	3.6 5.9	+1.4 — 0	+ 5.9 + 5.0	5.6 8.4	+1.4 — 0	+ 8.4 + 7.0
3.94- 4.73	1.1 2.6	+0.9 — 0	+ 2.6 + 2.0	1.6 3.9	+1.4 — 0	+ 3.9 + 3.0	2.6 4.9	+1.4 — 0	+ 4.9 + 4.0	4.6 6.9	+1.4 — 0	+ 6.9 + 6.0	6.6 9.4	+1.4 — 0	+ 9.4 + 8.0
4.73- 5.52	1.2 2.9	+1.0 — 0	+ 2.9 + 2.2	1.9 4.5	+1.6 — 0	+ 4.5 + 3.5	3.4 6.0	+1.6 — 0	+ 6.0 + 5.0	5.4 8.0	+1.6 — 0	+ 8.0 + 7.0	8.4 11.6	+1.6 — 0	+11.6 +10.0
5.52- 6.30	1.5 3.2	+1.0 — 0	+ 3.2 + 2.5	2.4 5.0	+1.6 — 0	+ 5.0 + 4.0	3.4 6.0	+1.6 — 0	+ 6.0 + 5.0	5.4 8.0	+1.6 — 0	+ 8.0 + 7.0	10.4 13.6	+1.6 — 0	+13.6 +12.0
6.30- 7.09	1.8 3.5	+1.0 — 0	+ 3.5 + 2.8	2.9 5.5	+1.6 — 0	+ 5.5 + 4.5	4.4 7.0	+1.6 — 0	+ 7.0 + 6.0	6.4 9.0	+1.6 — 0	+ 9.0 + 8.0	10.4 13.6	+1.6 — 0	+13.6 +12.0
7.09- 7.88	1.8 3.8	+1.2 — 0	+ 3.8 + 3.0	3.2 6.2	+1.8 — 0	+ 6.2 + 5.0	5.2 8.2	+1.8 — 0	+ 8.2 + 7.0	7.2 10.2	+1.8 — 0	+10.2 + 9.0	12.2 15.8	+1.8 — 0	+15.8 +14.0
7.88- 8.86	2.3 4.3	+1.2 — 0	+ 4.3 + 3.5	3.2 6.2	+1.8 — 0	+ 6.2 + 5.0	5.2 8.2	+1.8 — 0	+ 8.2 + 7.0	8.2 11.2	+1.8 — 0	+11.2 +10.0	14.2 17.8	+1.8 — 0	+17.8 +16.0
8.86- 9.85	2.3 4.3	+1.2 — 0	+ 4.3 + 3.5	4.2 7.2	+1.8 — 0	+ 7.2 + 6.0	6.2 9.2	+1.8 — 0	+ 9.2 + 8.0	10.2 13.2	+1.8 — 0	+13.2 +12.0	14.2 17.8	+1.8 — 0	+17.8 +16.0
9.85-11.03	2.8 4.9	+1.2 — 0	+ 4.9 + 4.0	4.0 7.2	+2.0 — 0	+ 7.2 + 6.0	7.0 10.2	+2.0 — 0	+10.2 + 9.0	10.0 13.2	+2.0 — 0	+13.2 +12.0	16.0 20.0	+2.0 — 0	+20.0 +18.0
11.03-12.41	2.8 4.9	+1.2 — 0	+ 4.9 + 4.0	5.0 8.2	+2.0 — 0	+ 8.2 + 7.0	7.0 10.2	+2.0 — 0	+10.2 + 9.0	12.0 15.2	+2.0 — 0	+15.2 +14.0	18.0 22.0	+2.0 — 0	+22.0 +20.0
12.41-13.98	3.1 5.5	+1.4 — 0	+ 5.5 + 4.5	5.8 9.4	+2.2 — 0	+ 9.4 + 8.0	7.8 11.4	+2.2 — 0	+11.4 +10.0	13.8 17.4	+2.2 — 0	+17.4 +16.0	19.8 24.2	+2.2 + 0	+24.2 +22.0
13.98-15.75	3.6 6.1	+1.4 — 0	+ 6.1 + 5.0	5.8 9.4	+2.2 — 0	+ 9.4 + 8.0	9.8 13.4	+2.2 — 0	+13.4 +12.0	15.8 19.4	+2.2 — 0	+19.4 +18.0	22.8 27.2	+2.2 — 0	+27.2 +25.0
15.75-17.72	4.4 7.0	+1.6 — 0	+ 7.0 + 6.0	6.5 10.6	+2.5 — 0	+10.6 + 9.0	9.5 13.6	+2.5 — 0	+13.6 +12.0	17.5 21.6	+2.5 — 0	+21.6 +20.0	25.5 30.5	+2.5 — 0	+30.5 +28.0
17.72-19.69	4.4 7.0	+1.6 — 0	+ 7.0 + 6.0	7.5 11.6	+2.5 — 0	+11.6 +10.0	11.5 15.6	+2.5 — 0	+15.6 +14.0	19.5 23.6	+2.5 — 0	+23.6 +22.0	27.5 32.5	+2.5 — 0	+32.5 +30.0
19.69-24.34	6.0 9.2	+2.0 — 0	+ 9.2 + 8.0	9.0 14.0	+3.0 — 0	+14.0 +12.0	15.0 20.0	+3.0 — 0	+20.0 +18.0	22.0 27.0	+3.0 — 0	+27.0 +25.0	32.0 38.0	+3.0 — 0	+38.0 +35.0
24.34-30.09	7.0 10.2	+2.0 — 0	+10.2 + 9.0	11.0 16.0	+3.0 — 0	+16.0 +14.0	17.0 22.0	+3.0 — 0	+22.0 +20.0	27.0 32.0	+3.0 — 0	+32.0 +30.0	37.0 43.0	+3.0 — 0	+43.0 +40.0
30.09-35.47	7.5 11.6	+2.5 — 0	+11.6 +10.0	14.0 20.5	+4.0 — 0	+20.5 +18.0	21.0 27.5	+4.0 — 0	+27.5 +25.0	31.0 37.5	+4.0 — 0	+37.5 +35.0	46.0 54.0	+4.0 — 0	+54.0 +50.0
35.47-41.49	9.5 13.6	+2.5 — 0	+13.6 +12.0	16.0 22.5	+4.0 — 0	+22.5 +20.0	24.0 30.5	+4.0 — 0	+30.5 +28.0	36.0 43.5	+4.0 — 0	+43.5 +40.0	56.0 64.0	+4.0 — 0	+64.0 +60.0
41.49-48.28	11.0 16.0	+3.0 — 0	+16.0 +14.0	17.0 25.0	+5.0 — 0	+25.0 +22.0	30.0 38.0	+5.0 — 0	+38.0 +35.0	45.0 53.0	+5.0 — 0	+53.0 +50.0	65.0 75.0	+5.0 — 0	+75.0 +70.0
48.28-56.19	13.0 18.0	+3.0 — 0	+18.0 +16.0	20.0 28.0	+5.0 — 0	+28.0 +25.0	35.0 43.0	+5.0 — 0	+43.0 +40.0	55.0 63.0	+5.0 — 0	+63.0 +60.0	75.0 85.0	+5.0 — 0	+85.0 +80.0

*All interferences and limits are in thousandths of an inch. Limits for holes and shafts are applied algebraically to the basic size to obtain the limits of size for the parts.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chapter news

Nominators name candidates for board

Annual Nominating Committee, pictured here, has made its choice of candidates for election to the 1957-58 Board of Directors by convention delegates in March. From the top: Joseph P. Crosby, chairman; A. B. Clark; B. J. Hazewinkel; James Horne; R. C. W. Peterson.

1956 Nominating Report

Your Committee feels responsible to present to the House of Delegates the best possible candidates for the Board of Directors. It is our job to thoroughly and objectively consider each nominee that could fulfill the duties of a board member. We feel that "popularity contests" caused by submitting more names, of less qualified persons, frequently prevent our Society from having the best managerial ability on our Board. The background of each candidate has been carefully reviewed as to executive ability, past services to the Society, and proper geographic representation.

In March the House of Delegates will elect fourteen National Directors; the fifteenth member of the Board is the retiring president, as provided by the Constitution, which also prescribes that incumbent national officers be included for nomination. Their record justifies renomination. Most of the remaining members of the current Board were elected for the first time last year. We feel that each has done an excellent job in this short time. We think another year of their services will further benefit the Society, so their names have been presented again.

To choose the remaining names necessary to fulfill the required number of candidates was extremely difficult, and we assure you that all possible candidates' records were reviewed. The fifteen names that we present with this report were unanimously selected by your committee. However, other names may be presented by the membership, in accordance with our Constitution.

Respectfully submitted,
The 1956 Nominating Committee

candidates

Gustave B. Berlien
Irving H. Buck
Harold E. Collins
George A. Goodwin
H. Dale Long
Wayne Ewing
Philip Marsilius
William Moreland
Joseph L. Petz
John X. Ryneska
Leslie C. Seager
Charles M. Smillie
William A. Thomas
Francis J. Sehn
Robert E. McKee

As provided by the ASTE Constitution, **Howard C. McMillen**, currently president of the Society, will automatically become a member of the 1957-1958 Board of Directors.

Harold E. Collins, first vice president and an incumbent national director, is manager of foreign operations for Hughes Tool Co., Houston, and a director of Hughes Tool Co., Ltd., Belfast, North Ireland. Now in his tenth term on the Board of Directors, his former national offices include those of treasurer, and third and second vice president of the Society. A charter member and past chairman of the Houston chapter, Mr. Collins became a senior member in 1939. He also belongs to ASM; the Army Ordnance Association; Institute of Production Engineers, England; and Verein Deutscher Ingenieure, Germany. He has served as a consultant on machine tools to the Commerce Department in Washintgon, D.C.

George A. Goodwin, second vice president, now serving his seventh term as a national director, is works manager of the Master Electric Co., Dayton, Ohio. Three times treasurer of the Society, he has also been member and past chairman of the National Finance Committee. He has served both as chairman and vice chairman for his chapter, Dayton, of which he was a charter member. A registered professional engineer, Mr. Goodwin has held various engineering positions since 1910, and is a member of the Advisory Committee on Tool Engineering at Sinclair College.

Gustave (Ben) Berlien, an incumbent national director, is a partner in Industrial Steel Treating Co. of Oakland, Calif. He was a member of the 1953 Annual Nominating Committee, and is in his third term on the National Editorial Committee, currently serving as its chairman. His many chapter offices include that of chairman. Mr. Berlien received his technical training at Northwestern University and Armour Institute of Technology. He has lectured widely for ASTE and ASM chapters, and has contributed numerous technical articles to metalworking publications. He is affiliated with ASM, Metal Treating Institute, American Society of Refrigerating Engineers, and many civic organizations.

Irving H. Buck, currently serving on the board of directors, is president of the Tool Supply & Engineering Co., Dallas, Texas. A charter member of North Texas chapter, he has been a senior member since 1942. He has served four terms on the National Membership Committee and, as area captain, was instrumental in the chartering of many new chapters in the Southwest. His many chapter offices include three terms as chapter chairman. He also belongs to the Dallas Engineering Club, the Chamber of Commerce, and is on the board of directors of Great Southwest Life Insurance Co.

Wayne Ewing, third vice president and a member of the present board of directors, is president of the Arrowsmith Tool and Die Co., Los Angeles, Calif. His national record includes the offices of secretary and fourth vice president. A member of the National Education Committee, he has also served as vice chairman of the National Membership Committee. His many Los Angeles chapter offices include those of chapter chairman, second and first vice chairman and delegate to the national convention for 2 years. Mr. Ewing is a member of the Society of Automotive Engineers and of both the Southern California and the National Tool & Die Association. He has also been active on county and state committees for the education of apprentices in tool engineering and tool and die making.

Philip R. Marsilius, a past chairman of the National Program Committee, and currently serving on the board of directors, is executive vice president of the Producto Machine Co., Bridgeport, Conn. and president of the Producto Corp., Detroit. A past chairman of Fairfield County chapter, Mr. Marsilius has held the post of government specialist for the tool and die industry, with the National Production Authority, Dept. of Commerce, Washington. He is a past president of the Southern Connecticut Tool & Die Manufacturers Association, and is vice president and a director of the National Tool and Die Manufacturers Association. Active in civic groups, he holds a B.S. degree from Norwich University and an M.S. from MIT.

name candidates for board

H. Dale Long, fourth vice president and currently in his second term on the board of directors, is president of Scully-Jones and Co. A past national treasurer, he has also been a member of the Annual Nominating Committee, and has served as chairman of the National Finance Committee. His offices in the Chicago chapter culminated in the chairmanship. In 1952, Mr. Long was chairman of the House of Delegates, and the same year served as co-host chairman of the Industrial Exposition. A graduate of the University of Illinois, he is active in many civic organizations.

John X. Ryneska, currently national treasurer and member of the National Finance and National Policy Coordinating Committees, is serving his first year on the board of directors. He is manager of purchasing for the General Plant Utilities Section of the Medium Steam Turbine, Generator & Gear Dept., General Electric Co., Lynn, Mass. His offices at the national level have included those of secretary of the Society, chairman of the National Constitution and By-Laws Committee, and member of the National Progress Committee, National Membership Review Committee, and the Annual Nominating Committee. Mr. Ryneska is past chairman of Boston chapter and was general chairman of the 1946 semiannual meeting. A member of the National Society of Professional Engineers and its Massachusetts counterpart, he is also affiliated with the National Purchasing Agents Association and is active in community affairs.

Joseph L. Petz, currently on the board of directors, is secretary-treasurer of both Petz Emery, Inc., and of J. L. Petz Co., Inc., in Pleasant Valley, N. Y He is now in his seventh term on the National Editorial Committee, with three terms as chairman to his credit. An active member of Mid-Hudson chapter, he has served as chapter chairman and in other capacities. Mr. Petz has taught tool design as an outside activity for many years, and is a member of the American Society for Metals.

Leslie C. Seager, incumbent national director, is chief production engineer with the Eimco Corp., Salt Lake City. A Ford Trade School alumnus, his previous experience with Ford Motor Co. includes setting up the Tool Design Dept. for Ford's London plant. Charter chairman of the Salt Lake City chapter and a registered professional engineer, he served five terms on the National Professional Engineering Committee, including one as chairman. He has helped to establish four-year tool engineering curricula at both Utah State College and Salt Lake City's Westminster College, the latter providing a cooperative work-training course in conjunction with local industry. As president of Utah Engineering Council, Mr. Seager worked toward upgrading his state's engineering registration law, and permitting registration in tool engineering. He also belongs to Great Britain's Institution of Production Engineers, and the American Ordnance Ass'n.

Robert E. McKee, now in his third term as chairman of the National Education Committee, was named training director of R. K. LeBlond Machine Tool Co., Cincinnati, Ohio in July, 1956. Formerly chapter education chairman of Ann Arbor Area chapter, he is now a member of the Cincinnati chapter. He has served on the National Name-Change Committee and was chairman of the Grade-Membership Committee. Mr. McKee's fourteen years of teaching and research experience at the University of Michigan, from which he received his master's degree in 1946, culminated in the rank of associate professor of mechanical engineering. During this time he has done research and consultant work for various companies and government agencies and had many papers published on the subjects of metal-cutting, machinability, and education. He is a member of the American Society of Engineering Education and other professional organizations.

Charles M. Smillie, now in his third term as a national director, is president of the C. M. Smillie Co. of Ferndale, Mich. He has served two years on the National Membership Committee, and is now a member of the National Professional Engineering Committee, of which he is a past chairman. A senior member of the Detroit chapter since 1940, he has held various chapter offices, including the chairmanship. Mr. Smillie is state chairman of the Advisory Council of Scientist and Engineer of the Selective Service System, and chairman of the Michigan District of the National Screw Machine Products Association. He is a registered professional engineer, and holds a degree in mechanical engineering.

William A. Thomas, an incumbent member of the board, is superintendent of manufacturing engineering at the machine shop and stamping plant of the Ford Motor Co. of Canada, Ltd., Windsor, Ont. A former national secretary and assistant secretary-treasurer, he has been chairman of both the Canadian National Standards Committee and the Canadian Data Sheet Subcommittee. A member of the National Standards Committee for four terms, he also served two terms on the Annual Nominating Committee. He has progressed through Windsor chapter offices of standards committee chairman, first and second vice chairman, and chapter chairman. Self educated in engineering, Mr. Thomas is Commander of the Windsor Power Squadron, lecturing on piloting and navigation.

Francis J. Sehn, chairman of the National Book Committee since 1952, is the owner of The Fran Sehn Co. of Detroit, Mich., a consulting firm affiliated with Press Automation Systems. He has served both on the Annual Nominating Committee and the National Standards Committee. He represents ASTE on the Pressed Metal Institute's Honor Award Committee, and is a member of the American Standards Association's B-32 Sectional Committee on Sheet Metal and Wire Standards. Mr. Sehn received his technical training at Wayne State University and Lawrence Institute. A registered professional engineer, he is affiliated with various engineering societies in Detroit.

William Moreland, currently national secretary and serving his second term on the board of directors, is vice president in charge of manufacturing of the F. E. Myers & Bros. Co., Ashland, Ohio. A past chairman of Rockford chapter, he is now affiliated with Mansfield chapter. He has held the chairmanship and vice chairmanship of the National Standards Committee, of which he was a member for ten years. Other committee work includes that on the Name-Change Committee, the Annual Nominating Committee, Progress Committee, and Policy Coordinating Committee. A member of Technical Committee #7, on Twist Drills, for the American Standards Association, Mr. Moreland is ASTE alternate on that organization's Mechanical Standards Board. A member of the Research Institute of America and other professional management groups, he is also associated with Ashland's Chamber of Commerce.

ASTE Insurance Available

Does your income need more protection than it is now getting? As an ASTE member, you are able to take out a "Health and Accident Insurance Policy" which offers you the following unusual features and benefits:

- **Any member up to the age of 70 may participate.**
- **There are no limitations or restrictions on disease or type of sickness.**
- **Nonconfining sickness or accidents do not necessitate reductions in benefits.**
- **Insurance cannot be terminated for any reason as long as the plan is in effect and ASTE membership is maintained until retirement or age 70.**
- **Coverage is not subject to an aggregate limit or prorating with any other insurance coverage a member may have.**
- **The only exceptions of coverage are suicide, war, military service, pregnancy, and noncommercially scheduled flying.**
- **ASTE's Income Protection plan will pay up to $100 weekly for disabilities resulting from illness, accident, or disease, either on or off the job.**
- **For accidental dismemberment or death, it will pay up to $10,000.**

How can I enroll in this group insurance plan?

Fill out the application blank, attach your check for the proper premium, and mail to ASTE Group Insurance Administration, 2210 Park Ave., 10th floor, Detroit 1, Mich.

If I am disabled for a long period of time, would I still have to pay the premiums?

No, the Plan provides for waiving the premium after you have been continuously disabled for six months.

When do benefits begin?

Weekly accident indemnity is payable from the first day or 91st day of total disability, depending on the plan selected.

Weekly sickness indemnity is payable from the first day of hospitalization, or the 8th day of disability, whichever occurs first; or 91st day of illness, depending on the plan selected.

How do I report my claims?

Claims will be reported to ASTE Group Insurance Administration, 2210 Park Ave., 10th floor, Detroit 1, Mich.

Who is underwriting this plan?

The Continental Casualty Co. of Chicago.

Who will administer the plan?

The ASTE Group Insurance Administration administers the Plan under the supervision and direction of the Committee, "Group Insurance for ASTE," and offers policyholders' service, premium collections, and claims.

HOUSTON

A Robert Yarnall Richie photograph courtesy of Schlumberger Well Surveying Corp.

Oil • Cattle • Chemicals

This is Houston

Photograph courtesy Houston Chamber of Commerce.

One of America's most fabulous cities is Houston, the site of ASTE's Silver Anniversary celebration and annual meeting in March, 1957.

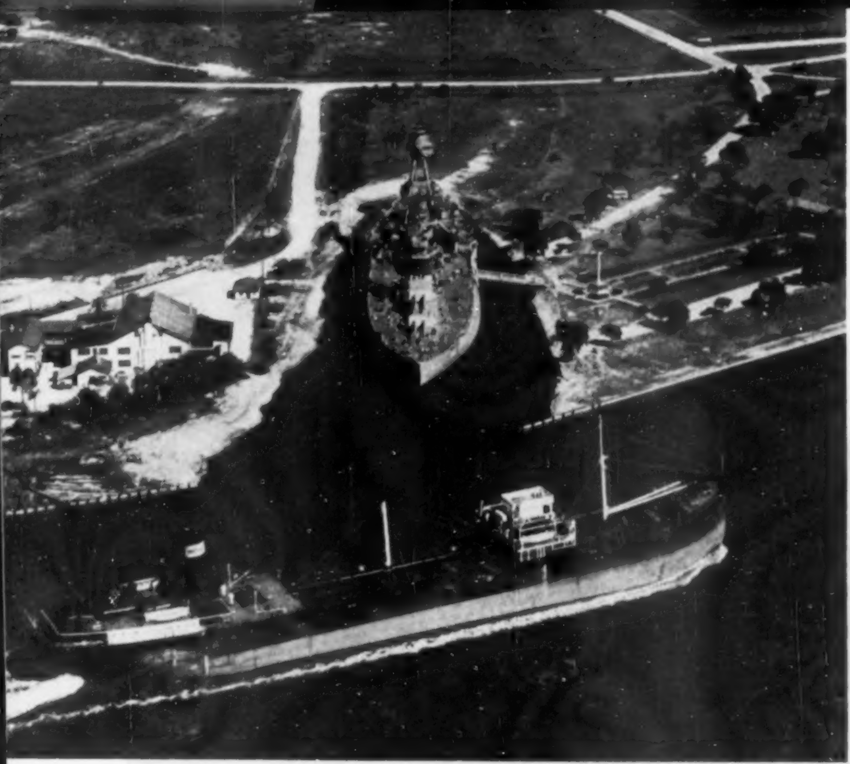
An industrial center in a cattle country, Houston is also oil capital of the United States, a bustling port (second in the U.S.) just 50 miles from the open sea; a city that supports three universities and a notable symphony orchestra. This metropolis, boastful of its many "firsts" in: concentration of petroleum, oil field equipment, manufacturing, and new chemical plants, is the South's largest city.

With more than 100,000 convention delegates each year arriving by train (six major rail systems) and plane (seven passenger services) and bus (nine lines), Houston more than meets the challenge in providing accommodations for her guests.

When packed convention schedules permit, busy delegates can shop in the city's largest and most complete department stores or seek exquisite items in exclusive shops. Sight-seeing around the city of Houston can include viewing live radio and television shows and visiting the famed gardens of Houston's fine homes, to enjoying the surrounding countryside —rich in historical lore.

Rising 570 feet in the air, taller than the Washington monument, stands Houston's San Jacinto Monument, marking the San Jacinto Battlefield where Texas in 1836 won her independence from the Republic of Mexico.

Storage tanks and fractionation towers of a modern oil refinery are shown here. (A Robert Yarnall Richie photograph, Schlumberger Well Surveying. Corp.)



Photograph courtesy Houston Chamber of Commerce.

Open to visitors, the USS Texas, internationally famed battleship of two World Wars, is shown in the permanent slip constructed at the edge of the Houston Ship Channel. A far cry from the muddy bayou it was in 1915 when the first ocean shipping service between Houston and the Atlantic coast was begun, the Houston Ship Channel can carry over 45 million tons of cargo.

mississippi

November 10 marked the chartering date of ASTE's 141st chapter, Mississippi. National Vice President H. E. Collins, left, is pictured installing the new officers who are: George Mitchell, chairman; Justus Alexander and Ray Schneller, vice chairmen; F. J. Stephenson, secretary; and John F. Doering, treasurer. To add to the festivities at the Jackson ceremonies, Staff Administrator Marvin Bunting, appeared on a TV program.

society grants two charters

southern technical institute

ASTE's sixteenth student chapter became a reality in Atlanta on November 9. Shown receiving the charter from Mr. Collins is the chairman, Richard G. Perry. Watching are Southern Tech officers, Chris Crenshaw, R. D. Landers and E. A. Yohan; Atlanta Chairman J. F. Morris; and Prof. C. R. Freeman, chapter faculty advisor.

industry and education night

climaxes 12-month plan

From Maine to California countless ASTE chapters successfully devoted their November meetings to Industry and Education Night, climaxing the Delegates' Twelve-Month Plan. Begun last April, the year-long Plan was evolved to acquaint educators and industrialists with the role of the tool engineer in industry, and ASTE's efforts toward promoting an awareness of the tool engineering field.

Plans were laid early to devote the November chapter meetings to strengthening the liaison between educators, engineers, and industry through ASTE. After thousands of contacts with key men in industry and institutions of higher learning, chapter members mapped their Industry and Education Night programs to reflect the aspects best suited to their groups.

The results have been overwhelmingly successful, with indications of increased interest already evident in the many requests for more information on ASTE, and tool engineering as a career. There follow samples of the various slants taken by representative chapters in attacking this phase of the Twelve-Month Plan.

I and E night at Ann Arbor

Prof. Karl Moltrecht, left, guest speaker, discusses the evening's topic with Ira Montague, chapter vice chairman, as treasurer Lawrence Charnitsky listens.

Aimed directly at the source of future generations of tool engineers, the Ann Arbor Area Industry and Education Night program spelled out for 45 visiting high school students and their instructors the definition of a tool engineer and his work. After University of Michigan Professor Karl Moltrecht's coverage of "Career Opportunities in Tool Engineering," by Ralph Eshelman, a panel discussion and question period ensued.

Panelists representing industry and education were present from the University of Michigan, Argus Camera Co. of Ann Arbor, and Ford Motor Co. Robert Caddell from the university pleaded the case for early and accurate planning of courses as the first step toward an engineering career. Clinton Harris, from Argus Camera, pointed out to his youthful audience that automation is the direct result of the high cost of labor, and consequently, manufacturers are anxious to invest in people and programs that will reduce this labor cost. He stated that men trained in the technical know-how to design and maintain more fully automated production schedules can command salaries directly proportional to their usefulness to the company.

Nine high schools from the surrounding areas were represented at the meeting. Students displayed projects from their technical classes, and the best examples were awarded six-inch Lufkin rules by David Peterson, chapter vice chairman.

Al Bethke, program chairman, had scheduled The DoAll Co.'s pictorial display, "The Story of Measurement" for the technical session. Narrating the accompany color slides, C. G. Schelley, managing director of the Wilke Foundation, made his talk readily comprehensible to the prospective engineers present.

Examining the DoAll exhibit are C. H. Harris, Karl Moltrecht, chapter chairman Hector Haas, and Lewis Yost, Bellville High School.

C. G. Schelly, left, explains a fine point to Robert Caddell, William Bone, and Albert Bethke.

Panelists, from left, are here shown talking with education chairman, W. T. Mercier, fourth left: W. A. McKeen, Firth Sterling; G. J. Shad, Carpenter Steel; P. R. Boreneman, Allegheny Steel; W. T. Mercier; R. Corey, Vanadium Alloys Steel; and E. E. Hall, Universal Cyclops Steel.

Pittsburgh

promotes plan

Developing the educational aspect of Industry and Education Night, Pittsburgh chapter planned its November 2 meeting as the sixth and final session of its Tool Steel Seminar, held during five consecutive weeks in October at Carnegie Institute of Technology. The meeting featured a "stump-the-expert" panel, consisting of authorities from ten leading tool steel companies which had participated in the seminar by providing its lecturers.

Chapter members, twenty-five industrial and educational guests, and some hundred and forty-eight graduates of the seminar attempted to stump experts from Allegheny Ludlum Steel Corp., Firth-Sterling, Inc., Vanadium-Alloys Steel Co., Latrobe Steel Co., and Bethlehem Steel Co. Other participating companies were The Carpenter Steel Co., Universals Cyclops Steel Corp., Braeburn Alloy Steel Co., Crucible Steel Co. of America, and Vulcan Crucible Steel Co.

The seminar sessions were devoted to the following subjects consequently: introduction to tool steel, cutting tools, punch press tools, hot work tools, cold work tools, "stump-the-experts" panel discussion. Certificates were awarded at the final session to graduates with a perfect attendance record.

In addition to the seminar, Pittsburgh chapter has cooperated with Pennsylvania State University Extension Service in developing a course in tool design. This education-conscious chapter is fulfilling a primary objective of the Twelve-Month Plan in stressing the importance of formal training as the most rapid method of producing highly qualified tool engineers.

Discussing details of the conference are: E. S. Phillips, chairman of Pittsburgh chapter; Robert McCord, Pennsylvania State University Ext.; Pittsburgh Treasurer W. F. Coles; and Pittsburgh Secretary R. J. Zale.

Educators chatting over dinner are, from left: James L. Shannon; Harold B. Black; Paul R. Bower; Henry W. Dosey; Charles F. Hoffmaster; Thomas Pryde; Walter S. Butler, and Ward N. Swain.

this is I-E night at...

philadelphia

At Philadelphia's I & E Night, A. R. Diamond, past chapter chairman, awards $500 scholarships and *Tool Engineers Handbooks* to P. K. Murphy of the University of Pennsylvania, and T. R. Galeone of Drexel Institute. Short talks were given by Mr. Stoner, of the state department of education, on trade schools; Mr. Watson, dean of Spring Garden Institute, whose topic was technical schools; and Mr. Stevens, dean of Drexel Institute, on engineering schools.

muskegon

Shown speaking on "Atomic Energy in Industry," at Muskegon's I & E Night, is James H. Climer, standing, staff assistant at Consumers Power Co. From left are: Edward Huttenga, director of cooperative training, Muskegon High School; Donald Hesling, vice president, Sealed Power Corp.; and William Bierema, program chairman.

erie

Erie chapter's I & E Night was held jointly with the Instrument Society of America and featured discussions by, from left: David B. Schuler, chapter chairman; William Moreland, national secretary; James A. Currie, president Erie Foundry Co., who described his company's manufacture of drap hammers and hydraulic presses; Al Johnson, president of the Erie chapter of ISA.

springfield

At Springfield, Illinois' I & E Night, from left, are representatives of education from the University of Illinois: Paul Dirksen, chapter chairman; and Professor Doyle, who discussed the tool engineering program being conducted at the university; Professor Trigger, a member of the national education committee, who discussed the present status and future of tool engineering at Illinois; and Director Ross J. Martin, who discussed national trends and policies in the university in engineering education.

syracuse

Syracuse chapter heard an interesting talk by Professor Bert Noress, left, on "The Education of the Engineer for Industry." Introducing him is Roland Hood of the Carrier Corp. James Pass, president of the Pass & Seymour Co., discussed the subject "Industry Needs Engineers."

hamilton

A. M. Moon, standing, center, Ontario Dept. of Education, spoke at Hamilton's I & E Night, urging industry to work with educational bodies to produce a mutual solution to the drop-out problem in secondary schools, and to provide advanced technical education to meet the demand for trained technical personnel. Mr. Moon also discussed the work being done in conjunction with the Trade Councils and the possibility of introducing so-called "sandwich courses and day-relief courses." Pictured are, standing left: Robert I. Hall, vice chairman; E. Evans; O. McIntyre; W. Durrant; R. G. Fechnay. Seated from left are: Joseph A. Sheldon; James O. Horne, national director; A. M. Moon; and Harvey B. Ward.

this is I-E night across the nation . . .

ASTE chapters across the nation carried to successful completion their Industry and Education programs.

"We must get out of the horse and buggy and into a jet," said Dr. M. J. O'Leary, principal of Springfield High School at **Twin States** I & E Night. Over a hundred educators and members of industry heard views of both sides during a panel discussion on how education is meeting the needs of the engineering field.

One of the highlights of the evening was the news of the inauguration of adult education engineering classes in Springfield, sponsored by ASTE, in cooperation with extension services of the Universities of Vermont and New Hampshire.

Mid-Hudson chapter approached this specially planned night, from the angle of "Partnership of Industry and Education." Maxwell Hannum, education director, NAM, pointed out in his talk before the chapter that industry is ready to help educators tell the story of American business, while Alfred Slon of Orange County Community College, cited the need for building up community college programs, which provide the opportunity for more qualified students to attend college.

Across the nation in **Santa Clara**, a panel discussing "The Tool Engineer: His Place in Industry and Education," stressed that tool engineers should first be engineers, and second, production specialists.

Monmouth chapter heard Dr. Maurice J. O'Sullivan, associate dean of Seton Hall University, explain that "terminal education," two years of junior college, may be the answer to the difficulty high school students have in deciding on a carrer. He pointed out that the shortage of trained engineers and skilled technicians should be somewhat alleviated by 1961 when 1938-41's high birth-rate will be available to industry.

One hundred forty attended **Racine's** I & E Night, where Rea Hahn, president of Walker Mfg. Co., stressed the fact that industry can best train the graduate engineer to meet its own special needs. He pointed out that human relations is the problem that faces today's engineer.

High points of **Greater New York's** I & E Night were: formal tool engineering education is becoming more scientific; colleges are veering from practical to scientific engineering; and practical shop experience in diversified fields continues to remain important to the training of the tool engineer.

Featured at **Greater Lancaster** was a talk by Prof. Harold Skamser, originator of the"Jets" program, Junior Engineering Technical Society, for high school students. Also appearing on the program was John Stauffer, Thaddeus Stevens Trade School, who suggested the possibility of a technical institute in the area.

los angeles

Los Angeles chapter and guests turned out 300 strong in ASTE's effort to bring industry and educators together in order that each might better understand the other's problems. Pictured from left are: Millard Fotter, head industrial engineer, California State Polytechnic College; George Adams of the National Book Committee; Dean Harold Hayes, California State Polytechnical College; Professor Morris Asinow, University of California; George L. Sullivan, registered professional engineer No. 1, California; Wayne Ewing, national vice president; G. P. Eichelsbach, McCulloch Motors; Chairman F. X. Bale.

Illinois Chapters Co-Sponsor IIT Conference

Some morning technical session speakers, seated from left are: Dr. A. G. Metcalfe, IIT; Frank Brugger, Kennametal; and Frank Hoke, U. S. Internal Revenue Service. Standing are: H. C. Miller, right, Armour Research Foundation; and W. C. McEachern, Revenue Service. Other Speakers at the morning session were Ray Jablonski, Carboloy; Wm. Storm, Campbell, Goldstein & Glade; and Chas. Weithman, Motorola.

Informative technical sessions combined with stimulating addresses on topics of current interest to make the sixth annual tool engineering conference at the Illinois Institute of Technology a success for some 150 participants. Based on the theme "New Horizons in Industry," the November 2 and 3 event was sponsored by the Illinois chapters of ASTE in cooperation with Illinois Tech, Northwestern and Illinois Universities.

Dr. John T. Rettaliata, president of IIT, spoke at the annual banquet, citing Russia's race for technological supremacy, and urging an intensification of effort to interest apt students in pursuing engineering careers. Speakers at a luncheon the same day were National President H. C. McMillen and Stanton E. Winston, IIT evening division dean.

At the "kickoff" session, automation was discussed, as seen through the eyes of labor by P. L. Siemiller, representing the International Association of Machinists; and from management's viewpoint, by Dr. Harry B. Osborn, Jr., representing Ohio Crankshaft Co. Dr. Richard Humphreys, from Armour Research Foundation, stressed the need of increased research to keep abreast of industry's demands.

Technical sessions were grouped under four general topics: new cutting materials, economics of machine tool replacement, new extrusion methods, and automation in the metalworking industry. Thirteen papers and a movie on cold extrusions were presented.

Planned to interest the ladies present was a series of talks on industrial design and city planning. Keki Bhote, world traveler, presented "India, Architect of the Neutral Bloc."

Members of the conference planning committee, seated from left are: Harry Eagan, Ralph G. Owens, S. E. Rusinoff, R. E. Betterley, and Roy B. Perkins. Standing from left are: L. H. Seabright, and K. J. Trigger of the National Education Committee.

chapter *news* and *views*

SAN FERNANDO VALLEY—National Vice President Wayne Ewing, back row left, and Director L. C. Seager, left front, reported on the Society's activities at the November 11 meeting. Other speakers were: front row, E. M. Thompson of Los Angeles City Schools; Dr. C. C. Crawford, U.S.C.; back row, C. J. Cribbon of Lockheed, speaking on tool design in the aircraft industry; and H. P. Camp, of California Apprenticeship Standards. —*A. J. Soares*

ST. LOUIS—Herman Zimmerman, professional engineer and member of St. Louis chapter, has been duly authorized to instruct the orientation course sponsored by the chapter on professional engineering in Missouri. There are already 18 chapter members enrolled for the July, 1957, semester.

Westinghouse Award To Boston Member

Milton Clayton Shaw, Boston chapter, received the 1956 George Westinghouse award for his creative work in the "science and application of lubrication, metal-cutting, and machine tools; for his effective contributions to engineering education in both the undergraduate and graduate fields; for his ability to inspire co-workers and students; and for his publications in several fields. . . ."

Mr. Shaw is professor of the machine tools and metal-cutting division of the mechanical engineering department at MIT. In 1948 he began the nucleus of the present Metal Cutting Laboratory which today is one of the most significant units of its kind, operating on an annual budget of $75,000.

Lima Hears Talk on Quality Control

Joseph Manuel, director of headquarters quality control, Westinghouse Electric, explained how tool and machine capabilities are measured to determine natural limits within which an operation would produce good parts.

Mr. Manuel described Eli Whitney's idea of making use of the principle of division of labor and of making the same part for all guns alike by following a model. This idea paved the way for mass production by utilizing the principle of interchangeability of parts.

Mr. Manuel went on to say that quality control engineers are looking for the one best method for obtaining optimum quality at minimum cost and that this method will also satisfy the tool engineer for minimum tool cost.

—*George Johoske*

ROCKFORD—Shown from left are: Marshall Samuelson, George Peacock, Clifford Lundquist, and Carl B. Kaiser, Ingersoll Milling Machine, who spoke on "The Story of Milling." —*Larry Geiger*

WESTERN RESERVE—Program Chairman Ray Beatty, right, shakes hands with Duncan Brown of Brown & Sharpe Mfg. Co., who spoke on modern grinding practices. Watching are Sandy Dittmar, left, also of Brown & Sharpe, and Chairman Gene Helfer. —*A. I. Bechtel*

PEORIA—Dr. Cylvia A. Sorkin, business consultant and economist, sparked the chapter's November meeting with her talk, "Would You Hire Yourself, Boss?" which included both the humorous and serious side of management's dealings with people. Chatting with her are, left, William Naumann, Caterpillar Plant manager; and Wilbur McWilliams, national delegate.

Sponsored by the National Education Committee to discuss operational problems was this meeting of Eastern student chapter faculty advisors. Shown, front left are: Messrs. Kinney, Mohawk Valley Tech; Updegrove, N. Y. City College; Potter, Alfred Tech; Eno, Canton Ag & Tech. Back row left are: Walsh, Boston chairman; Moody, Wentworth Institute; Bacik, staff administrator; Ames, Wentworth Institute; and D'Avella, Boston chapter education chairman.

Barrel Finishing Theme at Long Island

Long Island chapter met on November 12 to hear George Grant, Almco Supersheen, discuss barrel finishing.

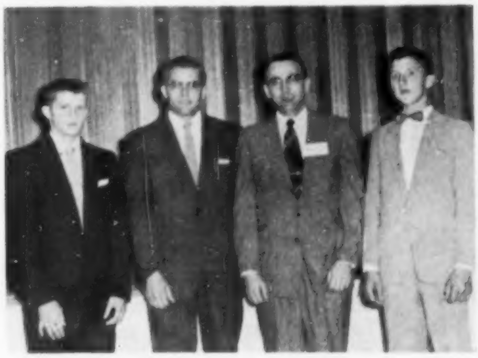
Defining barrel finishing as a "process for cleaning, polishing, descaling, and deburring wood, plastics, and metal on a large scale," Mr. Grant went on to describe its advantages.

Inherent economy resulting from the replacement of costly hand labor with a machine operation is advantageous along with the elimination of production bottlenecks, uniformity of finish obtained, space saving, and low-cost desired finish.

He suggested general rules for getting best results involving water levels, mixtures, rotational speeds of the barrel, the "roll-over point," and "radiusing."

—Robert W. Bradshaw

WINDSOR—Standards Committee shown here will take part in a second yearly Joint Industries Conference on electrical standards, Jan. 28, at the Windsor Chrysler plant. Committeemen are, front, from left: N. Paddison; W. Maddock, chairman; E. Clifton; and D. Nesbit. Standing: C. Wilson; B. Horton; L. Shelson; F. Atkins; G. Kovasi; and A. Hopkinson. *—J. Challoner*



LIMA—Guests from Lima Central Catholic High School attending the chapter meeting were: Robert Sarno, student; Roger Williams, instructor; Joel Kimmel, tool engineer; and Robert Kroger, student.

DETROIT—Dr. M. Eugene Merchant, Cincinnati Milling Machine Co., spoke on "Radioactive Cutting Tools," including significant laboratory development in determining or measuring tool abrasions by the application of radioactive principles. *—Tony Rogers*

GOLDEN GATE — Attending executive night are: William Martin, Marchant Research; Edgar Jessup, Marchant Calculators; Col. Calvin Heath, who declared that our very survival as a top world power depends on our making a tremendous increase in the number of engineers trained each year; and one of Golden Gate's founders, Walter Kassenbaum, Marchant Calculators, who stressed that the tool engineer is the man to cut manufacturing costs. —*Newell Partch*

chapter news and views

Rochester Offers Annual Scholarship

Rochester has established a $1,000 scholarship to offer financial assistance to selected high school seniors in the area, who intend to apply to Rochester Institute of Technology for the tool engineering course. The chapter is interested in selecting from Monroe County high schools, competent young people to train for some of the future tool engineering opportunities in Rochester industries.

This competitive scholarship will be awarded on the basis of the high school record, results of entrance examinations and personal interviews. The winners will attend the school as regular students in the tool engineering major of the mechanical department, and will have the opportunity for interviews for possible cooperative employment in training programs in Rochester.

—*Floyd Weed*

Peoria Welcomes First Woman Member

Justine Fellay, a tool design draftsman at Caterpillar Tractor Co., became Peoria's only woman member in October. She qualified for senior membership in ASTE with a background of 12 years' experience on a drawing board, plus a course in engineering drawing at Caterpillar. Walter Dingman, membership committeeman who encouraged Miss Fellay to join, is responsible for 25 new chapter members this year.

Miss Fellay plans to keep up her interest in tool engineering upon becoming the wife and partner of Robert K. Lindburg, of Labco Co., Somer, Connecticut. Mr. Lindburg, chemist in the poultry broiler industry, has developed especially for that field a hydraulically-operated fluid meter for liquid feeding and medicating.

BINGHAMTON—Douglas G. O'Brien, center, Corning Glass Works, presented a film on glass manufacture and products. Shown also, are: left, Chairman Wendell Harper and J. B. Wheeler, program chairman. —*Glyn Williams*

FORT WAYNE—Harry Stewart, right, Logansport Machine, outlined the development of hydraulic power. Shown from left are: Frank White, Logansport Machine; and Dave Chambers, Fort Wayne chapter. —*R. E. Snyder*

LITTLE RHODY—Jack H. Seikmann, left, General Electric, spoke on "Ceramics as the Fifth Generation of Tooling Materials." Shown also are Chairman Paul Watelet and program Chairman Frank DeLucian. —*Richard H. Kilbane*

NORTH TEXAS—John N. Heater, field engineer from Cincinnati Milling and Grinding Machine, Inc., who spoke at the Nov. 9 meeting, explains some samples of hydrospun parts to R. L. Holland, tool engineer from Convair.

—R. T. Parker

Schenectady Hears Ceramic Speaker

Dr. Louis Navias, ceramic consultant of General Electric's research laboratory, attracted and charmed the second largest audience in Schenectady's postwar history with his discussion of the application of ceramics and glass to tooling and manufacturing problems.

During the evening the chapter presented its first affiliate member plaque of its twenty years' history to the John E. Larrabee Co. of Amsterdam. Accepting the plaque was its treasurer, Thomas Leavenworth.

—John Sheridan

PEORIA—Justine Fellay, only woman member, is assisted in her application by Walter Dingman, membership committee, left, while Vice Chairman William Bahnfleth, Jr., and Membership Chairman Olin Simpson, watch. *—G. K. Davison*

At the National Professional Engineering Committee's meeting on Nov. 17, are shown, standing left: George Julien; J. R. Felter; A. R. Fairchild; L. C. Seager, national director; L. E. Doyle; C. M. Smillie, national director; and C. H. Thuman. Seated from left are: John Lengbridge; George Hargreaves; Chairman, V. H. Gallichotte; Howard Gross; and H. L. Aglietti.

LONG BEACH—"Automation in Industry Night" speakers are from left: Messrs. Chrissie; Sharpe, chief industrial engineer of Chrysler Motor Corp., who showed slides of automation on the Plymouth engine line at the Los Angeles plant; Alford, who spoke on the evolution of automatic riveters; Bannert, master mechanic, American Can Co., who presented a movie on the manufacture of tin cans; Warner, chief tool engineer, Grayson Controls, who discussed "Automation in the Field of Small Parts Manufacture;" and Stansbury, tool engineer, Douglas Aircraft Co., Inc., who discussed automation and acted as moderator. *—Dan B. Welty*

GRAND RIVER VALLEY—Harry Conn, left, Scully-Jones & Co., spoke on "Economics of Tooling for Production" at Grand River Valley's meeting. Shown also are Vice Chairman G. M. Dilly and Chairman C. K. Henderson.

—Grant S. Alpine

MOHAWK VALLEY TECH—Elizabeth O'Brien and Richard Burton, left, are shown joining the student chapter. Assisting are Nicholas Kinney, right, faculty advisor, and Student Chapter Chairman Joseph Yudiski.

—L. C. Schafer

"The Use of Standard Components for Automating Heavy-Duty Machining Operations" was the subject presented to **Akron** chapter by Thomas Farron of Michigan Drill Head Co.

Battle Creek members heard various aspects of automation described by Charles F. Hautau, president of Hautau Engineering Co.

Benton Harbor and **Lima** chapters heard a lecture and a panel discussion on the subject of "The Story of Measurement," sponsored by The DoAll Co. Participating in Lima's meeting were members from various other engineering societies.

"Gage Specifications for the Ordnance Dept." was presented by Glen Stimson of the Greenfield Tap and Die Corp., to **Buffalo-Niagara Frontier**. The fundamentals of thread and tap specifications were discussed along with methods of checking hole and tap threads with plug and ring gages.

Jack Harris of E. W. Bliss Co., spoke to **California State Polytechnic** student chapter on presses. Earlier, new officers were installed: Jay K. Bear, chairman; John Wilkin, vice chairman; Harold A. Cantrill, second vice chairman; Fred Tarver, secretary; and Rene V. Denuit, treasurer. Prof. Francis F. Whiting continues as advisor.

Canton chapter heard problems that metallurgists and the aircraft industry have come up against while incorporating titanium into airplane construction when W. W. Sheel of Republic, spoke on "Wonder Metal, Titanium." At an earlier meeting the chapter toured Hercules Motor Corp.

Wesley A. Kuhry, United Aircraft, discussed with **Chicago** chapter materials and design on future aircraft that will travel in outer space: supersonic aerodynamics, hypersonic aerodynamics, gas turbine fluid mechanics, and high-speed propulsion aerodynamics. The launching of a rocket was shown on film.

Detroit chapter heard George L. Huffman of Ex-Cell-O discuss "Automation in the Dairy Industry." Mr. Biehl of the Great Lakes Corp. gave a talk on how engineers should "Think on Their Feet."

"Management Challenges the Engineer" was the title of President McMillen's talk to **Evansville** chapter at its 10-year anniversary. Charles Thuman gave an historical resumé of the chapter, and songs of the Shrine Chanters were enjoyed.

Fox River Valley heard R. A. Gorman, president of Burgmaster Machinery, speak on man's social and industrial progress from primitive stone-age tools through the industrial revolution to the present day.

The principle of optical comparators was explained at **Houston's** meeting by James Allan of Jones and Lamson. He stressed the importance of light source and projector screen size as limiting factors.

Indianapolis chapter toured the Indianapolis Gear Works, producer of precision aircraft gears. All parts are heat treated to 38-52 Rockwell "C" before machining, and are machined to remove as much weight as possible and still have strength. On Nov. 1, C. Walter McCarty, editor of the Indianapolis News, spoke.

Kansas City heard A. M. Setapen, Handy & Harman, discuss the latest developments on silver and production brazing, effects of composition, humidity, and temperature on brazing of various types of metals, and honeycomb brazing for supersonic aircraft.

Malcolm Judkins, Firth-Sterling, Inc., spoke to **Lansing** chapter on nuclear energy for civilian use, the mechanics of fission from one element to another, fission in an atomic bomb and nuclear reactor, thermal and breeder type reactors.

Little Rock toured American Machine & Foundry, where Stanley C. Ampen of the company explained the problems involved when the plant recently was moved to the area.

Inclement weather on October 27 failed to dampen the spirits of **Mohawk Valley** chapter members when it forced festivities of their seventh annual picnic indoors. Planned and executed by the chapter's ladies, the program provided prizes, dancing, and refreshments.

Machinability expert H. J. Seikmann of General Electric compared cemented oxide tools with other types of the November 15 tech session of **Monadnock** chapter. He cited conditions under which ceramic tools would outperform those of carbide as to cutting speed and surface finish. ASTE Treasurer John Ryneska brought plans and policies of the Society before the group.

chapter

Dr. John R. Emens, president of Ball State Teachers College, addressed **Muncie** chapter at its Executive Night program, November 13.

"Automation" was the subject of a talk by J. D. Byrne of General Electric at **New Haven** chapter's November 8 technical session.

November 1 brought D. E. Bridge of Toronto's Ryerson Institute of Technology, to **Niagara District** chapter. Mr. Bridge's talk touched on the serious problem industry faces because of the current shortage of engineers, and outlined Ryerson's attempts to help solve the problem. Coffee speaker was George DeYoung, president of Atlas Steels Ltd., Welland.

John N. Heater, process engineer of Cincinnati Milling and Grinding Machines, Inc., brought the new processes of hydroforming and hydrospinning to the attention of **North Texas** chapter on November 9. He named the advantages of the hydroforming process as reduced cost of tooling, simplicity of setup, increase of material formed in single draw, and superior part quality, and stressed that hydrospinning is a method of *moving*, not *removing*, metal.

Northwestern Pennsylvania chapter members heard D. A. Dobbins from Diamonite Div. of U. S. Ceramic Tile

Co. discuss the composition and uses of oxide cutting tools, as compared to carbide and high-speed steel tools, on November 8.

Peterborough's November tour of the Orenda aircraft engine plant at Malton Ont., began with a talk by E. Bartell on the history of the Orenda engine and explanation of their three-dimensional plant layout. After seeing many operations including final assembly and testing of the jet engine, a question period was held on jet engine operation.

Ralph Moschella of Raytheon Mfg. equipment, and tool machine design.

Robert McKee, national education chairman, stressed the country's need for qualified tool engineers at the November 20 meeting of **Springfield,** Ohio, chapter.

Carbide turning for small and large-lot production was the subject of S. E. Beer, Monarch Machine Tool Co. on November 1. Speaking before **St. Louis** chapter, he showed two films to illustrate his talk, in which he noted the trend by machine tool builders toward greater horsepower and variable speed

activities

brought the story of ultrasonic machining to **Phoenix** chapter on November 12. The possibility of using ultrasonics for the separation of ore from mineral was discussed afterwards, since Arizona's lack of water makes normal methods impractical.

Following Coffee Speaker George Torrence's talk on Community Fund, **Rockford** chapter heard Nevin L. Bean of Ford Motor Co., Rockford, speak on "Automation in Russia" on October 11.

Speakers at **San Diego** chapter's November 16 program were Dr. E. B. O'Byrne of San Diego State College, National Vice President H. E. Collins, and B. F. Coggan from Convair.

The manufacture of die steels and hard edge band saw blades was the subject of a talk by Alick Tucker, Simonds Saw and Steel Co. at **Southeast Kansas'** November 8 technical session.

October 18 saw James Meehan, sales director of Brown & Sharpe, bring the subject of precision grinding of cylindrical parts before **Southeast Massachusetts'** membership.

Southern California Chapter's project is an apprentice tool design course offering on-the-job training, plus night school courses at the junior college level offered by Los Angeles City School System, beginning in February. The three-year, 6000-hour course will include basic tool design, assembly jigs and fixtures, machine tool fixtures, testing lathes with built-in memory units that vary the speed and feed as the diameter of the work gets smaller.

Tucson's members learned of the procedures used in applying for patents from Patent Attorney Willard L. Groene on October 9. His talk was entitled "Fuel of Interest for the Fire of Genius," and preceded the announcement of Garret Supply Co. of Phoenix and Los Angeles as an affiliate member of the chapter.

On November 12 at **Williamsport,** Pa., that city's chapter heard Herbert T. Smith of Ernst and Ernst, and Kenneth Carl, from Williamsport Technical Institute, discuss cooperation between management and education.

Iron Age Salutes Indianapolis Member

Joseph N. Huser, former Indianapolis chapter chairman, was honored in *Iron Age* magazine for his outstanding industrial accomplishment. President of the National Tool & Die Manufacturers Assn., an outstanding machine tool producer, Mr. Huser has served on U. S. trade missions to Europe and organized the Indiana Tool & Die Manufacturers Assn.

Entering the field as an apprentice in a Cincinnati machine shop, Mr. Huser was maintenance foreman by the time he was 20. Upon completing two years with the AEF in World War I, he became a toolmaker, then chief inspector in Indianapolis. In the mid-1930's he and a friend started an after-hours tool shop and by 1936, started their own company.

Mr. Huser's four sons are also in the tool and die industry.

Hartford Discusses Uses of Ceramics

Following a talk by Miss Nora Bresman on the Hartford Business Bureau, Dr. Bennet Bovarnick of Rodman Laboratories, Watertown Arsenal, presented a talk on manufacturing and experimenting of ceramics for metal-cutting. A comparison slide showed that for the same weight, the ceramic material volume was three times that of tungsten carbide.

Wallace Kennedy, Watertown Arsenal, lectured on testing and findings using new ceramic cutting tools.

Ceramics are not a "cure-all" but rather an important addition for today's cutting tools, was pointed out by Mr. Kennedy. Ceramics will augment, not replace, present-day tooling. He likened ceramics at this period to the late 1920's in the carbide industry.

—C. Morgan Newbury

PORTLAND, ORE.—Portland executive committee members pause for a portrait at a recent meeting. From left they are: Fred D. Mondin, membership; William Simpson, program; Kay Silvon, standards; Edward S. Reilly, second vice chairman; Robert C. Erickson, chapter chairman; Prof. Milton C. Sheely, first vice chairman; Daniel J. Melody, delegate; Richard Lyons, treasurer; and Joseph J. Lomnicki, secretary. William E. Brennan, constitution and bylaws, was absent. *—Walter L. Brenneke*

Coming Meetings

National

National Education Committee—Jan. 4-5, Terrace Plaza Hotel, Cincinnati, Ohio.

National Officers Meeting—Jan. 5, National Headquarters, Detroit.

Carbide Subcommittee of National Standards Committee—Jan. 7-8, National Headquarters, Detroit.

National Editorial Committee—Jan. 12, National Headquarters, Detroit.

Chapter

Ann Arbor Area—Jan. 16, 7 p.m. Dinner and plant tour, Burroughs plant, Plymouth, Mich.

Atlanta—Jan. 14, 6:30 p.m. Dinner, Cherokee Restaurant. Plant tour of Scripto Co.

Baltimore—Jan. 9, open meeting.

Battle Creek—Jan. 21, 7 p.m. Dinner, American Legion Club House. Talk on "Manufacture of Silverware." Ladies night and dance.

Benton Harbor-St. Joseph—Jan. 10, 7 p.m. Tosi's. "How Else Would You Make It" by Robert C. Cornell, acting publicity director, Midwest Area, American Die Casting Institute. Forty-five-minute film, panel discussion, display.

Binghamton—Jan. 9, 7 p.m. Frank Soper, chief process engineer, B.M.T. Mfg. Co. "Precision Barrel Finishing and the Proper Use of Abrasives and Compounds."

Boston—Jan. 10, 6:30 p.m., New England Mutual Hall. "Thread and Form Rolling" by C. T. Appleton, Reed Rolled Thread Die Co.

Buffalo-Niagara—Jan. 10, 6:30 p.m., Tuscarora Club, Lockport, N. Y. "Auto Crash Safety Research" by Edward Dye of Cornell Aeronautical Laboratory, Inc.

Cleveland—Jan. 10, 8 p.m., Hotel Statler. "Modern Drills and Drilling Technique" by Carl Oxford, Jr., Director of Research Engineering, National Twist Drill Co.

Columbus—Jan. 9, 6:30 p.m., Grandview Inn. "Automation" by N. Van Deusen, vice president, V & O Press Div., Emhart Mfg. Co.

Detroit—Jan. 17, Regular Section, Father, Son and Daughter Night. Jan. 10, Carbide Section, Rackham Bldg. "Machine Tools for Carbide" by Stanley Bradenburg, vice president, Monarch Machine Tool Co.

East Texas—Jan. 10, 7:30 p.m., Sky Way Restaurant at Gregg County Airport.

Elmira—Jan. 7, open meeting.

Evansville—Jan. 14, 6:30 p.m., Hadi Temple. "Automatic Presses and Feeding Devices" by Howard F. Sherman, sales engineer, Bliss Press Co. Film will also be shown.

Greater New York—Jan. 7, 6:30 p.m., New York Times Service Dining Room, 229 W. 43rd St. Talk on "Printed Circuitry;" coffee speaker, Col. Lloyd Stearns.

Hamilton District—Jan. 11, 6:30 p.m., Brant Hotel, Brantford. "Die Casting, How Else Would You Make It?" by Marshall Ralls, chairman Central Group, American Die Casting Institute.

Hartford—Jan. 7, "Ultrasonic Machining."

Indianapolis—Jan. 3, 8 p.m., Antlers Hotel. "Honing" by Ray Toerkoerpge, field service engineer, Sunnen Products Co., followed by colored movies.

Knoxville-Oak Ridge—Jan. 8, 7 p.m., The Dwarf Restaurant on Clinton Highway. "Powered Metallurgy" by research engineer, Chrysler Corp., Oilite Div., speaker to be announced. Display products and show film.

Long Beach—Jan. 9, 7 p.m., Chrysler Motor Corp., Los Angeles, plant tour.

Long Island—Jan. 14, 8:30 p.m., Garden City Hotel, Garden City, N. Y. "History of Drop Forging" by Robert Merrill, president, Merrill Bros.

Los Angeles—Jan. 10, 7 p.m., Scully's Restaurant. Coffee speaker, Commander A. M. Davidson, U. S. Coast Guard. Movie and talk, "Common Sense Afloat." "Chem-Milling" by George H. Fox, assistant sales manager, Chem-Mill Div., Turco Products, Inc.

Madison—Jan. 17, 7 p.m., Cuba Club. "Business Principles for Tool Engineers" by R. Cross.

Merrimack Valley—Jan. 3, Rex Grille. "Atom Goes to Sea" by Lester Moyes, General Electric.

Milwaukee—Jan. 19, 6:30 p.m., Elks' Club. Annual dinner dance. Proceeds to be used for chapter scholarships.

Monadnock—Jan. 17, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria, Keene, N. H. "Industrial Applications of Compressed Air, Including Oil Fog Lubrication" by Delbert G. Faust, vice president, sales & engineering, Norgren Co.

Monmouth—Jan. 8, 8 p.m., Joseph's Restaurant, Eatontown, N. J. "Ultrasonics—Its Theory, Operation and Application to Metalworking Industries" by Paul M. Unterweiser, Metallurgical Editor, Iron Age Magazine.

Mid-Hudson—Jan. 8, 6:30 p.m., the Mirabell, Poughkeepsie, "The Kodak Design Story" by Theodore G. Clement, design coordinator of Eastman Kodak Co.

Muncie—Jan. 8, 6:30 p.m., Empire Room, Delaware Hotel. "Obsolescence" by Carl M. Beach, domestic

sales manager and vice president of Cincinnati Milling Machine Co. Slides and motion picture, "Mr. Johnson and the Dragon."

MUSKEGON—Jan. 8, 6:30 p.m., Doo Drop Inn. "Silver Brazing and Production Brazing" by F. C. Brosnan, engineer, Handy & Harman Co.

NEBRASKA—Jan. 17, 6:30 p.m., Marchios Italian Cafe. "Industrial Heating" by speaker from Standard Furnace & Supply Co. Report on industry; education committee's functions.

NEW HAVEN—Jan. 10, 6:30 p.m., Hotel Garde. Talk, "Plastics in Small Parts Production."

NIAGARA DISTRICT — Jan. 3, 7 p.m., Queensway Hotel, St. Catharines, Ont. "Forging Practices in the United Kingdom" by J. G. Gill, works manager, and W. Morgan, quality control manager, Canadian Steel Improvements, Ltd., followed by discussion period.

NORTH TEXAS—Jan. 11, 7:30 p.m., dinner Amon Carter International Airport. "The Value of ASTE to Management" by Wayne Ewing, vice president ASTE.

NORTHERN MASSACHUSETTS—Jan. 15, 7 p.m., Union Twist Drill Recreation Hall, Athol, Mass. "Design and Manufacture of Better Mousetraps" by Harry J. Dixon, engineer, Metallurgical Products Co.

NORTHWESTERN PENNSYLVANIA—Jan. 3, 8 p.m., Moose Club, Emporium, Pa. "Ball and Roller Bearings—Design, Manufacture and Application" by Daniel Lundquist, Eng. Supervisor.

OKLAHOMA CITY—Jan. 8, 7 p.m., Oklahoma City University, Green Room. Film, "The American Engineer" followed by a talk "Review of Significant Engineering Developments Across 21 States."

PHILADELPHIA—Jan. 17, 6:30 p.m., Williamson Trade School, Elwyn, Pa. Panel discussion, tour of school and talk entitled "Trade School Curricula."

PONTIAC—Jan. 17, 8 p.m. Michigan Abrasive Corp., 11900 E. 8-Mile Rd. Plant tour.

PORTLAND, ORE.—Jan. 17, 6:30 p.m., Burns Restaurant. "Abrasives in Industry" by H. G. Brustline, district manager, Norton Co., Abrasive Div.

ROCHESTER—Jan. 7. "Automation" by Harry Conn, Scully-Jones and Co. Affiliate member night.

ST. LOUIS—Jan. 3, 7 p.m., Kingsway Hotel. Father and Son night. Special local speaker, tool engineer and former ball player.

SAGINAW VALLEY—Jan. 17, Frankenmuth. "Bearings—Design and Application" by Sam Weckstein, Timken Roller Bearing Co.

SAN DIEGO—Jan. 8, 7 p.m., El Morocco Club. "Basic Considerations in Aluminum Forming" by E. V. Sharpnack, Sr., chief forming engineer, Reynolds Metals Co. Slides and movies.

SPRINGFIELD, ILL.—Jan. 8, 7 p.m., Lake Club. Annual ladies night.

TOLEDO—Jan. 9, Education Night.

TORONTO—Jan. 9, 7:30 p.m., Canadian Steel Improvement, Ltd., plant tour.

TRENTON-DELAWARE VALLEY—Jan. 21, 6:30 p.m., Hotel Hildebrecht. O. J. Seeds, sales manager of Cerro de Pasco Corp., on "Low Temperature Melting Alloys as Production Aids," accompanied by slides and sketches.

TRI-CITIES—Jan. 9. "Investment Castings," guest speaker, Haynes-Stellite Co.

TWIN CITIES—Jan. 2, 6 p.m., social; 8 p.m., meeting, Covered Wagon. "Uses Unlimited" by H. Bares, service field engineer, Minneapolis Honeywell Regulator Co.

TWIN STATES—Jan. 9, 7 p.m., Adna Brown Hotel. "Radioactive Cobalt in Medical Therapy" by Dr. Frank W. Lane, staff Mary Hitchcock Hospital.

UNIVERSITY OF WICHITA—Jan. 25, 7 p.m., Coleman Air Conditioner Plant. Plant tour.

WINDSOR—Jan. 14, 7 p.m., Prince Edward Hotel. Joint Industries Conference. The Automotive and Aircraft Parts Mfg. Assn. will conduct a panel discussion on die casting. Meeting to be sponsored by Atlas Steel Co. of Canada.

WORCESTER—Jan. 8, 7:30 p.m., Putnam & Thurston's Restaurant. "Progress in Precision" by D. T. Peden, Micromatic Hone Corp.

members on the MOVE

Howard L. Roat, Flint chapter, has been appointed manufacturing manager of the Flint plants of AC Spark Plug Div., General Motors. Mr. Roat formerly was director of production engineering, and has contributed an article "Applying Creativity to Manufacturing Problems" to THE TOOL ENGINEER.

Four Chicago chapter members have received professional engineering licenses: **Donald H. Rimbey,** design engineer, Foote Bros. Gear & Machinery; **Hugh B. Meserve,** machine design, Hannifin Corp.; **C. A. Black,** mechanical tube mill specialization, A. J. Boynton & Co.; **Irving R. Wirth,** mechanical designer of materials handling equipment, Link Belt Co.

Roy Houck, Centinela Valley chapter, has been named the new western district manager for Adamas Carbide Corp., Kenilworth, N. J. Mr. Houck for over 12 years has specialized in aircraft industry applications.

Northern New Jersey chapter's **John Burg** was named eastern district manager of Kearney & Trecker Corp.

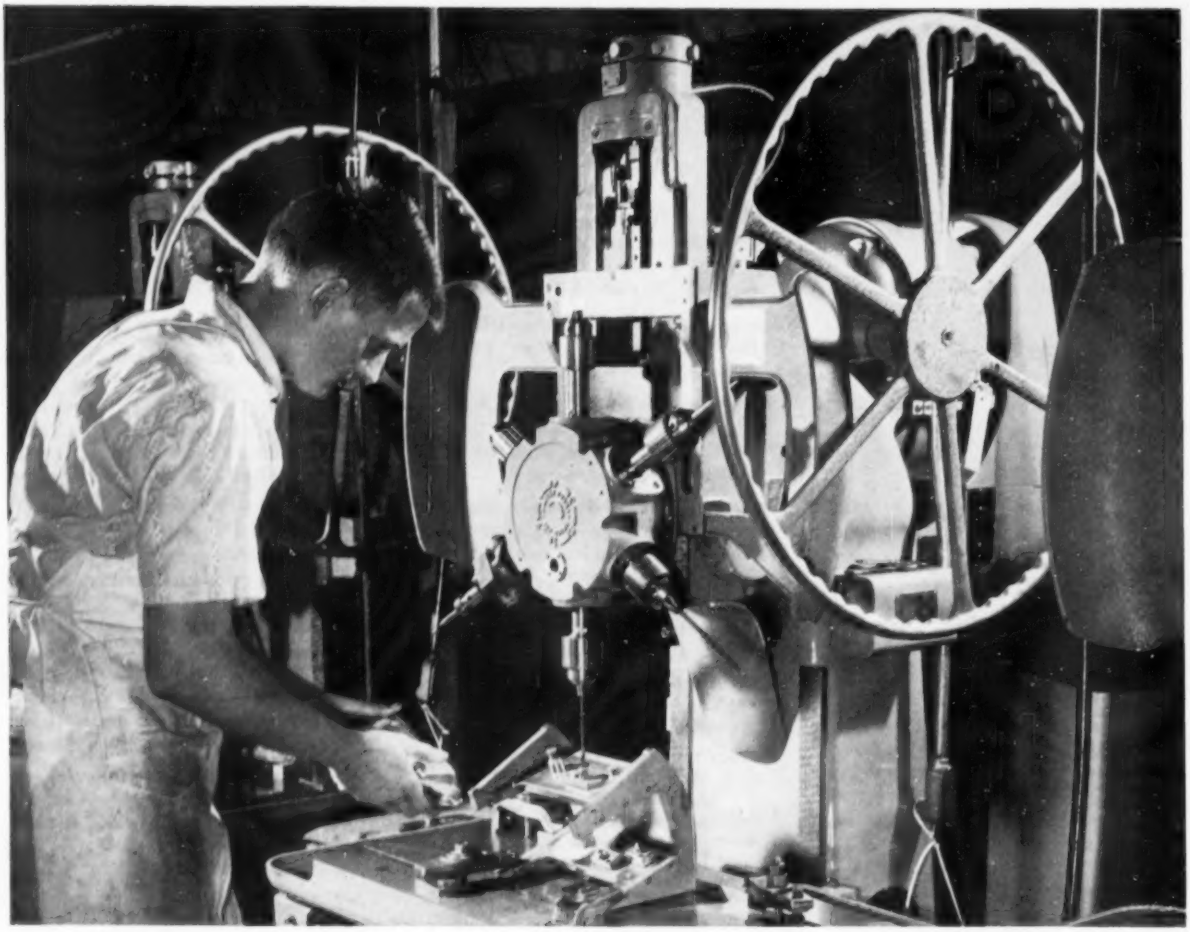
Position Available

TEACHING POSITION assistant or associate professor in Industrial Engineering. Need experienced man from diversified industries in production planning and control, tooling and mechanization, and other production areas. Research facilities in these areas, cooperative industries assist. Advanced degrees helpful. Excellent consulting opportunities. Beautiful campus. Nine-month contract. Some teaching experience desirable; can develop new courses. Salary open. Write: Department of Industrial Engineering, Washington University, St. Louis 5, Missouri.

Obituaries

William H. Lentz of Greater New York chapter, secretary and treasurer of Arista Design Process Corp.

Dr. John M. Speck, past chairman and officer of Des Moines chapter, tool engineer, Solar Aircraft.



PROGRESS IN PRODUCTION

AIRCRAFT INDUSTRY PLANS LARGE-SCALE USE OF NUMERICAL CONTROL

By mid 1957 many aircraft plants will be operating numerically controlled machines, according to a report recently released by the Aircraft Industries Assn. Some proof of this pudding is found in the estimate that the Air Materiel Command now has on order over 600 machines embracing at least four different systems of numerical control.

The AIA study represents one of the most extensive surveys of developments in this field and includes field trips to seven European countries. The report discloses some remarkable advantages for numerical controls when applied to a specific test part. Compared to present production methods, one test with a converted standard machine showed a reduction of $\frac{2}{3}$ in manual office paperwork, a 98 percent cut in data processing time, a 75 percent drop in general machining time and an 80 percent reduction of boring time.

The AIA subcommittee is especially concerned with problems that will arise with the rapid introduction of numerical control to production machining. Some of the operating problems they foresee are in compatibility of the various systems, data processing, special organizational needs, labor relations and the need for devising numerical format for engineering drawings.

Of immediate personal interest to tool engineers is the problem of coordination of the various skills required for successful operation of numerical control. The report indicates these will include those of the machine parts planner, the tool designer, cutting tool designer, lines layout or lofting, engineering liaison and machine load planning. Work interchangeability between machines may prove a headache, while quality control will pose some unusual questions. Can tape preparation be inspected and certified? What will inspectors use for references, since drawings do not always completely define all requirements a part must meet? Are automatic inspection machines a supplementary need so that production parts can be compared with tape data?

Further, active management support from the top down is a prerequisite to effective application of the new technology. This support must be preceded by an understanding of the proper areas of application, effect on organizational structure and other ramifications. The educational task is made difficult by the complexity of the subject and the variety of systems. The survey finds that virtually all major machine-tool builders, electric-control manufacturers and electronic-equipment producers have entered the field of numerical control, as well as at least three major airframe manufacturers.

In its work to standardize systems and bring order out of the confusion, the AIA group expects to publish a chart and related data early in 1957, showing the salient features of each system. This, it is expected, will aid engineers in evaluating equipment in terms of their own requirements.

It is anticipated that there will be negative reports on performance of some of the first machines. The principle, however, has been found to be completely sound and practical. So much so that the prediction is made that by 1958 the aircraft industry will probably be engaged in a large-scale replacement of uneconomical equipment.

TEMPERING TECHNIQUE OFFERS FORGING ECONOMY

Production of aluminum alloy hand forgings with low level of internal stresses has been made possible through a new tempering process developed by Aluminum Co. of America. The new technique results in reduced machining and straightening time and consequent production economy. It is based on precisely controlled cold reduction following solution heat treatment.

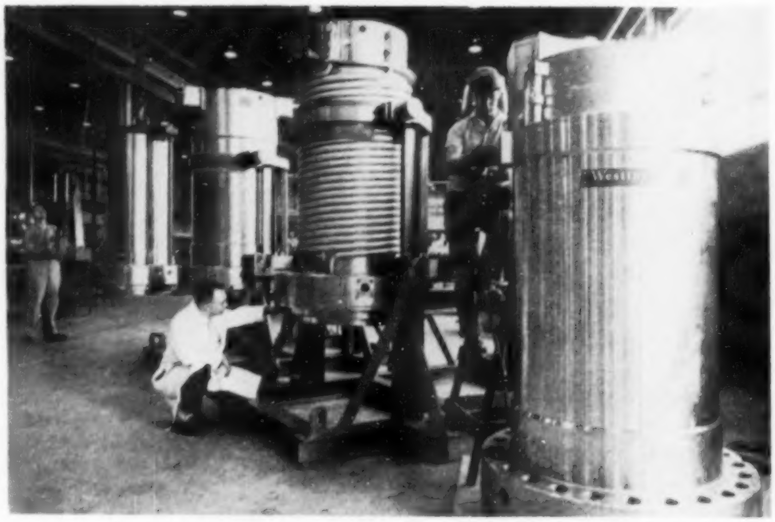
The treatment, designated T65 temper, has been extensively applied to hand forgings and rolled rings in alloy X7079. Tests show less internal stresses but reduced warpage from machining. A machined hand forging in alloy X7079-T65 shows warpage similar to that found in stretched plate and extrusions. As little as zero warpage has resulted in some forgings machined to extremely unbalanced proportions.

SUPERSONIC WIND TUNNEL USES GIANT CAP SCREWS

Fifty hexagonal socket-head cap screws, measuring $4\frac{1}{2}$ inches in diameter and having a combined weight of 2 tons, are being made for use in the supersonic nozzle assembly of the Arnold Engineering Development Center propulsion wind tunnel. Because the

quantity is so small and the fasteners are so large, they are being made on precision tool-making equipment by the Cleveland Cap Screw Co. Finished threads will have a Class 3 fit.

Threads and shanks are machine, and the threads are formed on a centerless grinder. Following heat treatment to 38-42 R_C, threads are ground to a surface finish of 32 microinches, rms, on a cylindrical grinder. The AISI 4140 cap screws are then silver plated over a nickel undercoat.



BIG CANNED-MOTOR PUMPS READIED FOR POWER PLANT

Four 1600-hp 2300-v canned-motor pumps are being completed for use as the main coolant pumps for the Duquesne Light Co.'s full-scale atomic electric-generating station. These four pumps, constructed by Westinghouse Electric Corp., will be used in the primary (radioactive) loops of a pressurized water reactor. They will circulate cooling water from the reactor to four boilers.

The stationary outer coils and the rotors of these pumps are individually "canned" in metal. Radioactive water flows through the space between them. These are the first canned-motor pumps with Class H insulation to be designed for 2300-v operation. Each pump weighs about 14 tons, and has a capacity of 12,300 gpm at 2000 psi. Water temperature can be as high as 600 F. There are no external shaft seals in these motor pumps, and suction and discharge nozzles are designed to be welded into the pipeline.

THIN ALUMINUM-OXIDE COAT ADDS WEAR RESISTANCE

All common engineering metals, except chrome and nickel plate, and many other materials can now be protected by aluminum oxide coatings applied by the Linde Flame-Plating process. Applied by the same techniques used to place a thin layer of tungsten carbide on metal parts (see THE TOOL ENGINEER, Jan. 1956, pp. 117-122), the aluminum-oxide coating has good resistance to chemical attack and to high-temperature deterioration. It is characterized by hardness, abrasion resistance and low porosity.

The aluminum-oxide can be applied in thicknesses up to 0.04 inch and the bond is more than adequate where deformation of the base material is not involved. As coated, the coating has a porosity of less than 1 percent and a surface finish of 125-150 microinches,

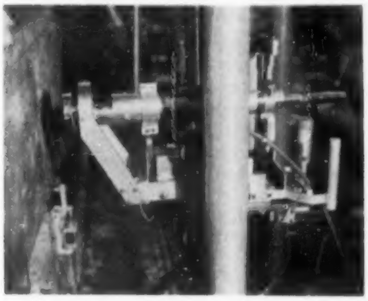
rms. It can be brushed to a surface finish of 30-40, diamond ground to 16 or diamond lapped to 1-2 microinches, rms.

While the coating can be considered to be protective, the best combination is a base metal that will withstand corrosion or oxidation and an aluminum oxide coating added for wear resistance. In most instances where the coating cannot prevent attack on the base metal, however, it does retard the attack. Since the temperature of the base metal does not exceed 400 F during application of the aluminum oxide, metallurgical properties of the base metal are maintained.

PERPENDICULAR CUTS WITH SELF-ALIGNING COUNTERSINK

Strategic use of three precision limit switches has resulted in a self-aligning countersinking machine that saves about 23 seconds per hole. In addition to this saving, the unit insures that the countersink is perpendicular to the metal surface and that it stops at the correct depth. This equipment is used by the Glenn L. Martin Co. for preparing aircraft fuselage and wing-skin sections for flush-driven flat-head rivets.

Heart of the countersinking unit is a standard air-feed drill, held in a gimbal so it is free to swing. The limit switches are mounted to form a triangle in the nose of the drill-holding unit. These



switches control a solenoid-operated air valve, which can operate only if all three switches are closed. Since the switches lie in the same plane—a plane perpendicular to the axis of the countersink—the unit can operate only if the countersink is perpendicular to the work.

Design of the mechanism includes a magnet for locking the drill in position on its track. An air cylinder is used to press the countersing against the workpiece. Correct countersinking depth is achieved by means of a pressure pad that can be adjusted to force the unit away from the workpiece, thus opening the limit switches and stopping the drill.

AUTOMATIC CONTROLS LEAD TO INCREASED PRODUCTIVITY

Adoption of automatic controls for production and assembly operations, by both large and small companies, has been predicted as the only way in which estimates of a $560-billion gross national product can materialize in 1966. An executive of Robertshaw-Fulton has said that the labor force can expand only about 14 percent in the next 10 years while gross product will increase about 40 percent.

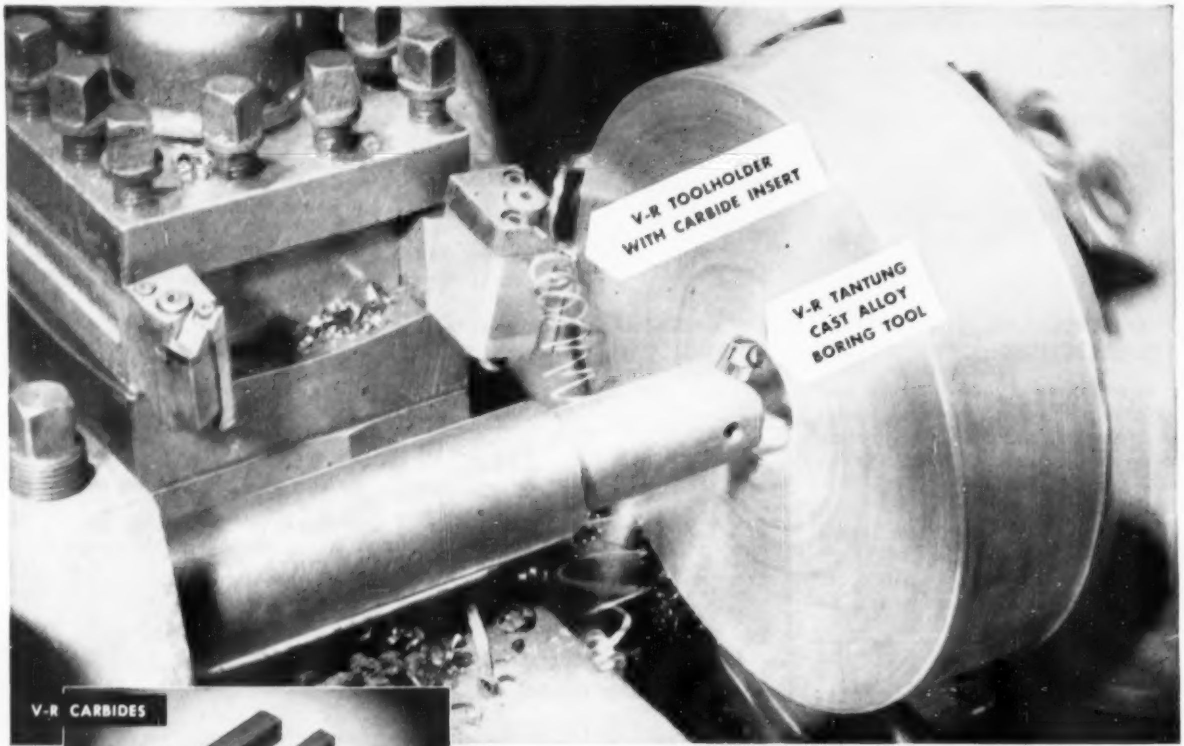
Automation and automatic computation will be applied to small specialty manufacturers to aid in increasing productivity. Automation is already being adopted because it can reduce production costs, increase product uniformity, increase safety and make possible processes not formerly possible.

HEAVY EXTRUSION PRESS NOW IN FULL PRODUCTION

The first big extrusion press to be operated in the West under the Air Force Heavy Press Program is now turning out large wing, fuselage and structural aircraft and guided missile components at the Torrance plant of Harvey Aluminum. Capable of exerting a pressure of 8100 tons, this hydraulic press produces high-strength aluminum alloy shapes. These one-piece structural shapes supplant parts made by joining many smaller components, thereby resulting in substantial weight and cost reductions.

This press has an over-all length of 288 feet and weighs 4,000,000 lb. A companion 12,000-ton extrusion press, the largest to date, is now being assembled at the Torrance plant.

How Multiple Tooling with Carbides and Tantung Cast Alloy Can Reduce Machining Costs



V-R CARBIDES

V-R TANTUNG

V-R TOOL HOLDERS

Surface Speed Dictates Choice of Tool

The boring and turning operations on normalized oil hardening tool steel pictured above illustrate the economies possible by correct use of both carbide and cast alloy cutting tools. The 8" O.D. is being turned at 450 surface feet per minute (215 RPM) with a V-R toolholder and throwaway carbide insert. The boring speed is 112.6 SFPM on the 2" I.D. At this lower speed carbide tool life is drastically reduced by build-up, while H.S. steel tools fail prematurely because of excessive heat.

The answer is to use V-R Tantung cast alloy for the boring operation. At 112.6 SFPM Tantung tool life is markedly superior to carbide or high speed steel. The reduction in regrinds and downtime results in higher production and major cost reduction.

Vascoloy-Ramet manufactures a complete line of both carbide and Tantung cutting tools to provide maximum machining economy on any job. For complete details and CATALOGS, call your V-R Representative or Distributor or write to V-R today.

FREE Surface Speed Table and Tool Selector Chart

This handy chart shows the general cutting speed range for HSS, TANTUNG and CARBIDES . . . shows RPM for various diameters to deliver surface speed desired. Ask for your copy—no obligation.

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

810 Market Street • Waukegan, Illinois

CT-607

TOOLS of today

Vertical Shaper

Intended for toolroom work and short production runs, the shaper illustrated is used for machining of regular or irregular, internal or external contours in a single setup. The machine provides 11½-in. longitudinal and transverse carriage movements, plus rotary movement through a built-in 12½-in. diam rotary table. Lateral movements are obtained by handwheel-operated leadscrews, with worm and worm gear movement of the table.

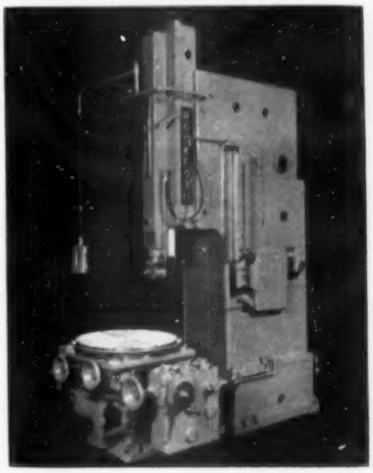
Ram stroke is adjustable up to 5 in. Accelerated ram speed on the return stroke is obtained by a rocker arm in the ram drive. The shaper is driven through a multiple V-belt drive from a 2-hp motor enclosed in the base.

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.

T-1-1551

Hydraulic Slotter

Model SA slotter, 36-in. stroke, is designed to handle large awkward work, irregular sections, internal surfaces, and angular and rotary cuts. The machine features a combination of mechanical leverage and hydraulic control for the ram drive. The torque drive arm permits an infinite speed adjustment from 40 to 100 fpm with constant horsepower characteristics. Speeds below 40 fpm are available by means of a flow control valve. Ram reversals are fast, smooth and accurate over the full range of the machine.



Cutting speed and all power movements are controlled at an overhanging pendant. A cutting indicator on the machine column indicates the approximate ram speed being used. Start and stop levers are installed on both sides of the column.

The machine is provided with wide-range longitudinal and transverse table travel, plus 360-deg rotary table movement. A dividing head provides for the accurate spacing of keyways, serrations, gear teeth and other jobs requiring precision indexing.

Other features include power rapid traverse in all directions, stroke length adjustment when the ram is in motion and a mechanically balanced ram with a tilt of 10 deg from the vertical.

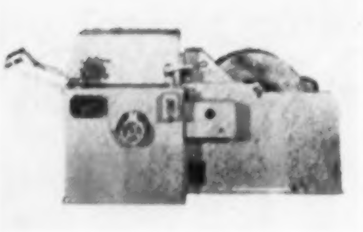
A 15-hp variable-delivery, radial-piston pump is used for hydraulic power, Electrical equipment is standard.

Rockford Machine Tool Co., Dept. Z, 2500 Kishwaukee St., Rockford, Ill. **T-1-1552**

Coil Straightener

Combination coil cradle and straightening machines are designed to feed leveled stock to all types of presses. Stock weighing up to 15,000 lb can be handled by these machines with 6, 7 or 9 rolls provided for straightening, according to model. Standard manually controlled variable-speed drive with a four-to-one reduction permits selection of feed speeds from 30 to 120 fpm. The drive operates continuously and is synchronized with the press.

Oversized hard alloy steel leveling and pinch rolls are used in all machines. Lower rolls are driven through heavy spur gears. Upper straightening rolls are adjustable individually or as a group. Upper pinch rolls are mounted in slide pillow blocks and held in tension by adjustable heavy-duty springs. A manual release lever is provided for



instant opening or closing of pinch rolls.

The conveyor type cradle has adjustable guide plates which rotate with the coil, protecting edges of stock against damage. Loading is accomplished by lowering the coil into the cradle with a hoist or with coil storage cars or loading racks.

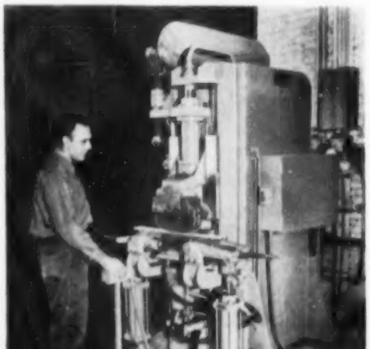
The Brandes Press Co., 6408 Euclid Ave., Cleveland 3, Ohio. **T-1-1561**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tube Bending Press

Vertical-ram hydraulic tube bending press is capable of making two or more bends in each of two or more tubes. It can also bend two different angles in the same U-frame. Full ram tonnage is available for the bending action, because the center clamp moves with the ram and the cushion does not oppose the ram tonnage.

The press can handle up to 1-in. OD steel tubing with minimum distortion of



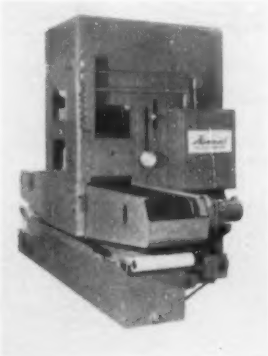
the tube and can also be used for bending nonferrous tubing. It has twin equalizing cushion cylinders, variable speeds, single adjustment for wing dies, retracting ram dies and changeable wedge inserts for ram dies.

Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill. **T-1-1562**

Belt Grinder

Model FF-12 "Flat Finisher" is designed for wet abrasive belt grinding, polishing and deburring of flat work such as sheets, strips, bars, stampings, and plates up to 12 in. wide and 6 in. high. Continuous feeding of work is accomplished with a variable-speed, air-tensioned endless conveyor.

The machine head is to two-roll design, employing an abrasive belt 12 in. wide by 126 in. long. It consists of a large diameter tracking idler pulley, a



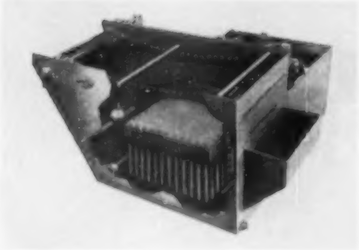
heavy dovetail slide for work height adjustment and a contact roll driven by up to a 25-hp motor.

Other features and optional equipment include power elevation for head adjustment to the work, 6 to 10 in. diam contact rolls, adjustable hold-down rolls, magnetic conveyor platen and automatic coolant filter.

Hammond Machinery Builders, Inc., Kalamazoo, Mich. **T-1-1571**

Tubular Screen Filter

Designed for filtration of coolants, cutting oils and other liquids requiring removal of minute particles, the filter illustrated has 5 to 1000 gpm flow capacities. It operates as follows: small-diameter screen tubes are manifolded together into a common-suction header through which the sludge-laden liquid is drawn by a multiple-chamber valve and pumped into a filtered liquid compartment. As the screen deposits reduce the liquid flow through the tubes, the unfiltered liquid level begins to rise. At a predetermined level, a float actuates a switch controlling the multiple-chamber valve, reversing the flow of the liquid. The reversed flow backwashes accumulated deposits from the screen. The level of the unfiltered liquid continues to rise and the float again reverses the flow of liquid through the valve, returning to the filtering cycle.



Sludge removed from the screen tubes drops to the bottom of the filter compartment, where it is removed by chain driven dragouts.

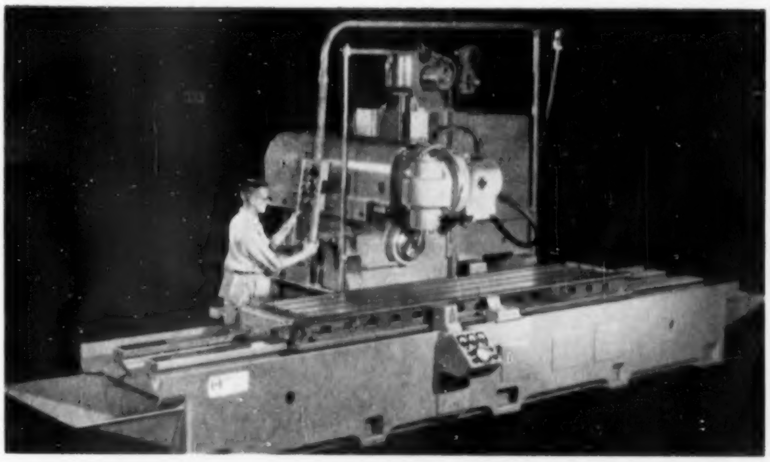
Industrial Filtration Co., Lebanon, Ind. **T-1-1572**

Universal Milling Machine

Longitudinal feed of the table, cross feed of the column and vertical feed of the head are combined on the bed type milling machine illustrated. These feed motions are provided by motors independent of the spindle motor, thus providing full horsepower to the spindle.

The machine is provided with a ram type head which is adjustable through an arc of 360 deg, both parallel and crosswise to the machine table to give practically any cutting angle desired. When not in use, the head can be retracted to clear the horizontal spindle.

Twenty-four speed changes are available on both the horizontal spindle and



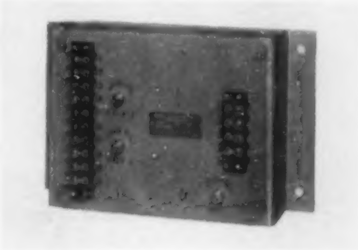
all-angle head, in a range from 14 to 1450 rpm. With the main spindle, the horsepower range is 1 hp per rpm up to 50-hp max. With the all-angle head, ½ hp per rpm up to 20-hp max. is available. Feed movements are infinitely variable, within the machine range. Control switches are located on the pendant.

Vernier scales are provided for table, column and head positioning. Mechanical screw feeds make it possible to apply controlled tracing and programming.

Sundstrand Machine Tool Co., Rockford, Ill. **T-1-1591**

Machine Controls

A transistorized servo amplifier, illustrated, and an electrohydraulic servo valve make possible electrohydraulic control of industrial machinery. They combine electronic signal sensing with hydraulic control of variable delivery pumps, hydraulic motors, cylinders and similar equipment, making it practicable to use hydraulic power for many



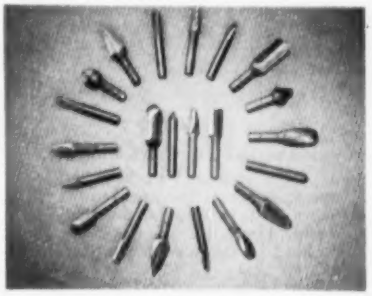
applications previously limited to electric drives and providing precision control of existing hydraulic equipment which could not previously be automatically controlled.

With the amplifier and valve, linear motion control can be applied to hydraulic presses, reciprocating drives used in planers, grinders or saw mill carriages and also for straight-line positioning. Rotary motion applications include lead screw feeds, spindle drives and process machinery.

Minneapolis - Honeywell Regulator Co., 2747 4th Ave. S., Minneapolis, Minn. **T-1-1592**

Carbide Mills

Made of solid carbide, these rotary tools feature a right-hand double cut with a left-hand spiral tooth. They are intended for die, mold and pattern work



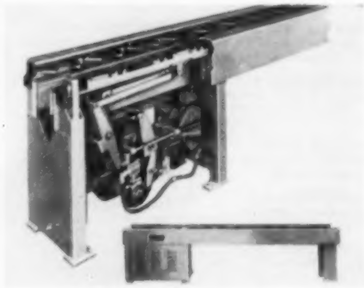
and for other applications such as deburring, finishing, blending, forming and elongating.

Severance Tool Industries, Inc., 728 Iowa St., Saginaw, Mich. **T-1-1593**

In-Line Transfer Table

Designed for piece parts which have a flat surface on which to slide along a track from station to station, this transfer table will cam-lock parts at each station within 0.005-in. tolerance without auxiliary locating devices. When tolerance is less than 0.005 in., a shot pin or locating lug on the part can be utilized.

The base of the unit contains an in-



termittent drive which can be located at either end or in the middle of the table to suit production requirements. Index distance can be varied from 3 to 9 in. and index time can be adjusted from 0.25 to 0.7 sec. Dwell time is also adjustable. Tables are available in lengths from 5 to 12 ft.

Dixon Automatic Tool Inc., 2300 23rd Ave., Rockford, Ill. **T-1-1601**

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Optical Comparator

Tolerance limits, hard-to-measure dimensions and critical points of an object can be quickly measured with the optical comparator illustrated, which is available in two bench models and a floor stand pedestal type unit. Four lenses, mounted in a revolving turret, permit magnifications up to 100X.

When the image is illuminated from below, the outline of the object is pro-

jected on the screen. When illuminated from above, the surface of the object can be examined for texture, finish, corrosion, wear etc.

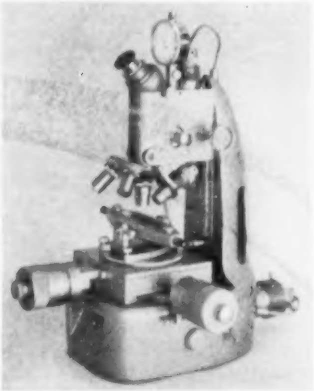
Accessories include a photographic kit, a cross traveling and rotating micrometer stage, a rotating protractor screen with scales and verniers, stage fixtures and a surface smoothness detecting device for measuring the profile curve of a surface.

Nikon, Inc., 251 Fourth Ave., New York 10, N. Y. **T-1-1602**

Toolmaker's Microscope

Model TM microscope combines in one stand a toolmaker's microscope for precise shop measurements and a complete metallurgical microscope for examination of metal grain structure. Magnification range is 30-400 power. Higher magnifications can be obtained with accessory optics.

The instrument gives direct readings

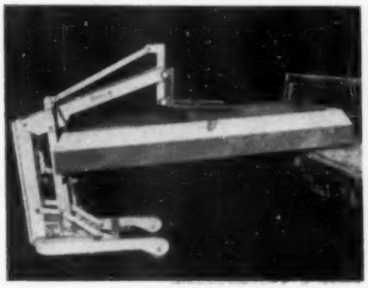


to 0.0001 in. in three dimensions by means of large micrometer drums which move the stage and a dial indicator which measures depth by optical contact with the specimen. Other features incude three separate light sources for substage, overhead and vertical illumination; combination rectangular ball bearing stage and circular rotary stage; inclinable toolholder; transformer built into base; coarse and fine focusing; revolving nosepiece with 3x, 10x and 40x objectives, and crossline 10x eyepiece.

Unitron Instrument Div. of United Scientific Co., 204-206 Milk St., Boston 9, Mass. **T-1-1611**

Fork Truck

Unusual design of the fork truck illustrated eliminates the necessity for counterweights to balance the load. The truck weighs less than 3000 lb. A crane type load arm can reach up to a 108-in. lift height and deposit loads well back



into truck beds. Long stock can be carried down an aisle parallel to the aisle. A compensating column assures straight-line vertical lift under all conditions, keeping load moment constant at all positions.

Driving controls are a pedal drive and a steering wheel. When not being accelerated, the truck is automatically braked. An inching speed is provided. Battery changing takes two minutes.

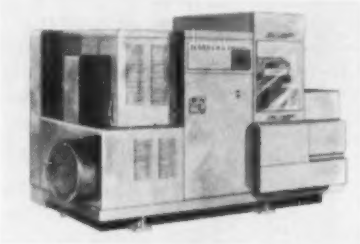
Autoquip Corp., 1140 S. Washtenaw, Chicago 12, Ill. **T-1-1612**

Single-Spindle Automatic

Engineered for fast machining of large, complex workpieces, the Model 3AC single-spindle chucking automatic can be used for both short and long production runs. During the machining cycle, spindle feeds, feed changes, cutting stroke length, turret indexing and both front and rear cross slide operation can be automatically regulated. Speed and feed changes can be made under cut to maintain optimum cutting

conditions. The machine operator has only to load the workpiece, press the cycle start button, and then unload the finished work when machining is completed.

Standard shank type turret lathe toolholders can be used interchangeably on the machine. Swing over the cross slide is 13½ in. Maximum pentagon turret working stroke is 11 in. The spindle



has an 11-in. type A-2 American Standard flanged nose and is equipped with an air-operated 15-in. chuck.

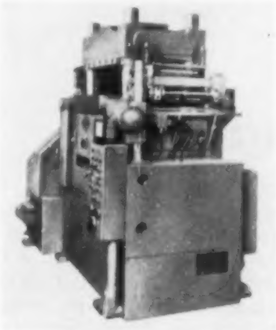
The standard drive motor is a 40-hp, nonreversing type unit. Two-speed and reversing motors are available for special requirements.

The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

T-1-1621

Automatic Stamping Press

No pit is required for the 75-ton double-crank direct-drive press illustrated. The press is operated at the shoulder level of the operator and stroke and adjustment are up. Drive



mechanism is in the base of the press.

Standard stroke is 2 in., with a maximum stroke of 4 in. Speed with the 2-in. stroke is 150 strokes per minute. The clutch is a combination flywheel type, air-operated with multiple friction disks and synchronized with a multiple-disk brake. Air counterbalances offset the weight of heavy dies and reciprocating parts.

A roll type feed mechanism is pro-

vided as an integral part of the press. It can accommodate metal up to $13\frac{1}{2}$ in. wide and up to $\frac{3}{16}$ in. thick.

Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich.
T-1-1631

Actuator Switch

Available in two types, this hinged-lever actuator switch features ease of removal or assembly of the lever, making it possible to use standard parts and add secondary operations to the lever to meet special application requirements. It has only one moving part.

Both types have a pretravel maximum of 0.250 in., an overtravel minimum of

0.200 in. and movement differentials of 0.020 to 0.080. Maximum operating forces are 18g for the Type A switch and 10g for the Type B switch. Minimum release forces are 9g and 4g, respectively.

TyniSwitch Dept., Detroit Controls Corp., 800 Union Ave., Bridgeport, Conn. **T-1-1632**

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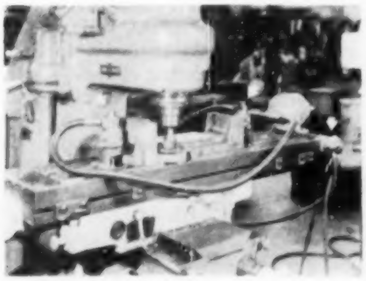
Power Clamps

Air-hydraulic setup clamps can be used to clamp a workpiece directly to a machine table. Other uses include clamping workpieces to fixtures, locking production parts together for assembly and similar operations. They can also be used to exert direct force as a small ram or press.

The clamping heads are available in

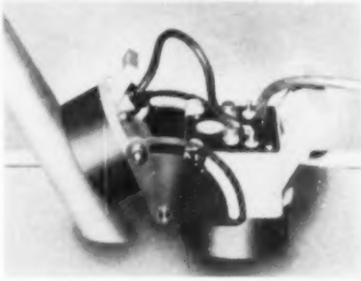


a range of models and sizes suitable for most clamping operations and can be installed on existing fixtures. One to four clamping heads with matching T-head nuts, air controls, an air-hydraulic booster, a rapid return valve and all necessary air and hydraulic hoses with preassembled fittings are included as standard parts.

Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. **T-1-1641**

Welding Fixture

Magnetic welding fixture holds ferrous metals in position for welding at any angle without preliminary setup

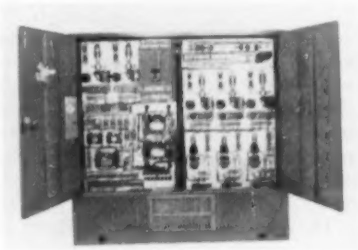


time. Available in three models with a maximum capacity of over one ton.

Magnetic Tool Corp., 1955 Lafayette St., Santa Clara, Calif. **T-1-1642**

Electronic Drive

This all-electronic variable speed drive is available in capacities from 30 to 150 hp. It consists of an operator's control station, electronic control unit and a d-c motor. The control is comprised of an ignitron-controlled three-phase, full-wave rectifier system with its



associated firing circuits, variable field supply, tachometer feedback, and protection and switchgear circuits.

With the exception of the motor, all components are static and have no inertial properties to slow down the system response. Size of the 100-hp unit is 5 x 5 x 2½ ft.

To meet future needs for increased automation, the drive is adaptable for inclusion in automatic systems. A small

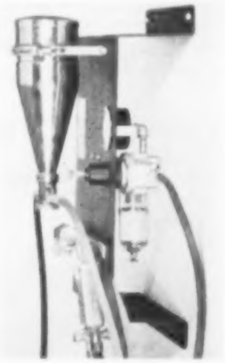
d-c voltage can control the motor speed. This control voltage is available as a function of the speed setting on the operator's control station, or one or more external voltages can be derived from transducers integrated in a machine or process.

Raytheon Mfg. Co., Commercial Equipment Div., Waltham, Mass.
T-1-1651

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Metal Powder Spray Unit

Model C-2 metal spray unit is intended for applying hard-facing alloys and other metals in powder form to most types of steel, cast iron and copper parts by the Sprayweld process. In this process, the powdered alloys are first applied by spraying and then are



fusion-bonded to the part by heating with an oxyacetylene flame.

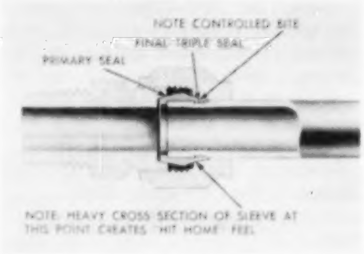
Components of the unit are mounted on a crackle-finish panel, and include a 3-lb aluminum pistol, a chromium-plated hopper, a carburetor, a combination air regulator-filter, and suitable oxygen, acetylene and powder hoses and fittings.

Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. **T-1-1652**

Tube Fitting

Forming a butt joint, the fitting illustrated consists of a body, nut and alloy-steel sleeve. It is engineered to withstand high pressures, hydraulic surge, vibration and other severe operating conditions.

A shoulder on the sleeve prevents incorrect assembly. Three serrated edges on the sleeve bite radially into the tube surface to a controlled depth, making a triple seal. The sleeve will not move longitudinally in assembly, scrape or shave tubing, and there is



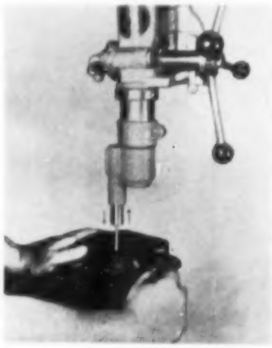
no torquing of the tube when the joint is made.

Conforming to JIC hydraulic standards and ASME code for pressure piping, the fitting is available in a wide range of types and shapes, in sizes for $\frac{1}{8}$ to $1\frac{1}{2}$-in. OD tubing. It can be used with steel, stainless steel, copper aluminum, everdur and monel tubing.

Imperial Brass Mfg. Co., 1200 Harrison St., Chicago 7, Ill. **T-1-1661**

Reciprocating Converter

Model RC vertical reciprocating converter can be used on any drill press equipped with a chuck taper spindle,

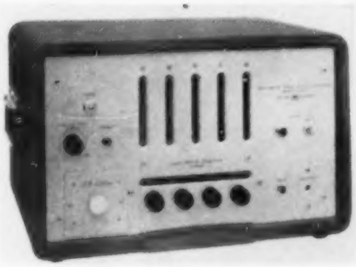


adapting it for vertical sawing, filing or slotting. Available in 1-in. and $1\frac{3}{4}$-in. stroke models.

Hunter Tools, Box 564, Whittier, Calif. **T-1-1662**

Computing Indicator

Precise measurements of speed, revolutions, pressure, thickness and other quantities can be read directly in the desired units with the DY-2500 electronic counter. It has a variable gate time that functions as a multiplier of the transducer input to provide direct readings. A front panel plug-in board automatically sets any predetermined conversion multiplier. Gate time may also be selected manually and is adjustable from 0.0001 to 0.9999 in 0.0001-sec. increments. There is also provision for a second input to permit measuring ratios



of two independent variables and direct readings of such quantities as engine revolutions per gallon.

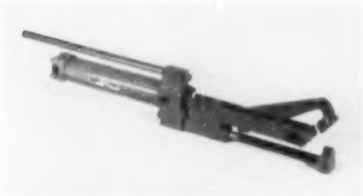
A pushbutton on the front panel permits a quick check of proper operation. The instrument is easily operated correctly without highly skilled personnel.

Dynac, Inc., subsidiary of Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif. **T-1-1671**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Vertical Flange Jaw Assembly

Designed to fit conventional air-powered straight-line or swinging-arm types of press unloaders, this jaw assembly will unload stampings having vertical flanges at the point of pickup. It is made in two models, each having

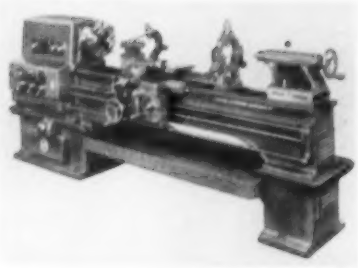


1¼-in. jaw openings. Model 715 has a 7-in. stroke and a 1½-in. diam cylinder. Model 820 has an 8-in. stroke with a 2-in. diam cylinder. Nylon or neoprene jaw inserts are available, in addition to standard hardened steel inserts.

Press Automation Systems, Inc., 18616 Wyoming Ave., Detroit 21, Mich. **T-1-1672**

Lathes

Line of toolroom and production lathes is available in 12 sizes, from 12 x 20 to 20 x 100 in. The 20 x 60-in. geared-head lathe illustrated has 18 spindle speeds and 56 longitudinal and cross feeds. Speeds, ranging up to 3000 rpm, are selected by a gearbox control lever. The final high-speed spindle drive is actuated by a direct



V-belt transmission, bypassing the gears, to insure high surface finish.

Controls are centrally located, with all dials and calibrations designed for easy readability. The motor and other electrical components are readily accessible for maintenance.

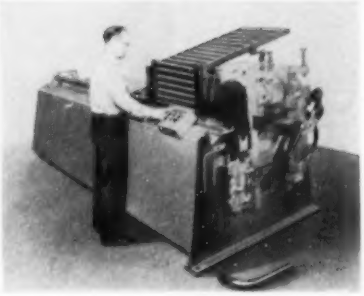
S & S Machinery Co., Brooklyn, N. Y.
T-1-1681

Bending Machine

Fed from a magazine, a heavy-duty, high-speed tube bending machine will automatically bend 2-in. diam steel tubes 90 deg in a four-sec. cycle. The machine utilizes a single-rotation hydraulic actuator to provide continuous power throughout the bending operation. A two-pump hydraulic system is provided. One pump controls a 2000-psi clamping system and the other powers a 1000-psi bending system.

All electrical and hydraulic power units and controls are mounted in the welded steel machine base. Mounting conforms to JIC standards. Manual and automatic control cycles are included in a pushbutton control panel.

For automatic operation, tubes are gravity fed from the magazine to a



position in front of a hydraulic cylinder-operated mandrel. When the cycle button is pressed, the mandrel advances a tube to bending position between the dies. A cylinder on the die table clamps the tube and the die table is rotated by an actuator. During this time, the mandrel returns to pickup position.

A combination of hydraulic, mechanical and electrical stops controls the bend angle. At the end of the bend, the clamping cylinder releases and the operator removes the completed part.

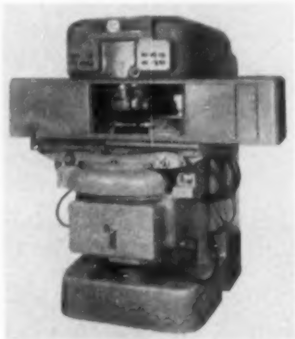
The machine is approximately 10 ft. long, 4 ft. wide and 5 ft. high.

Walter P. Hill, Inc., 22184 Telegraph Rd., Detroit 19, Mich. **T-1-1682**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Gear Shavers

Available in two models, an improved line of rotary gear shavers features a special column design to provide space for electrical controls and enable flush-mounting of two pushbutton control panels in the top of the



column within easy reach of the operator. The cutter drive gearbox is located in the top of the column, giving ready access for maintenance.

Model GCU-8 is equipped for semi-automatic loading and will shave spur or helical gears up to 4-diametral pitch with pitch diameters from 1 to 8 inches. Model GCU-12 shaves spur or helical

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-1-46	Acme Industrial Co.	**Drill Bushings**—Catalog contains data on micro, standard and tungsten carbide drill jig bushings, and dowel pins. Page 46
A-1-245	The American Brass Co.	**Non-Ferrous Material**—Data on "Formbrite" contained in catalog B-39. Page 245
A-1-12	The American Tool Works Co.	**Radial Drills**—Bulletin 328 contains data of clamping action on American Radial Drilling Machines. Page 12
A-1-190	Armstrong Bros. Tool Co.	**Tool Holders**—Catalog contains data on tool holders and carbide inserts. Page 190
A-1-42	The Aro Equipment Corp.	**Air Tools**—Engineering specifications on Par-A-Matic installations contained in Bulletin 5546-T. Page 42
A-1-209	The Atrax Co.	**Carbide Tools**—Latest edition of the Atrax catalog now ready for distribution. Page 209
A-1-182	The Bullard Co.	**Lathe**—Specifications on Hydra-Feed Lathe contained in catalog. Page 182
A-1-173	Carter Controls, Inc.	**Cylinders**—Parts data, specifications and prices listed in catalog. Page 173
A-1-296-1	Cerro de Pasco Corp.	**Materials**—Bulletin contains data on low-temperature melting alloys. Page 296
A-1-230-2	The Challange Machinery Co.	**Inspection Equipment**—Challenge Precision Surface Equipment described in Catalog No. 838W. Page 230
A-1-208	Chicago Rivet & Machine Co.	**Rivets**—Catalog contains engineering data and rivet specifications. Page 208
A-1-269	Cincinnati Grinders, Inc.	**Grinders**—Cincinnati Filmatic No. 2 centerless grinder described in Catalog No. G-644-1. Page 269
A-1-199	Circular Tool Co., Inc.	**Circular Saws**—Catalog O contains details for cutting aluminum extrusions. Page 199
A-1-260	The Cleveland Crane & Eng. Co.	**Shearing Equipment**—Catalog No. 2010 gives construction and engineering details. Page 260
A-1-212-2	Arthur A. Crafts Co., Inc.	**Carbide Form Tools**—Catalog available on "Complete Carbide Tooling for Automation." Page 212
A-1-240	Crucible Steel Company	**High Speed Steel**—"Crucible Publication Catalog" contains helpful hints on Rex and other special steels. Page 240
A-1-273	Danly Machine Specialties, Inc.	**Die Set Data**—Bolster plate accessories and die set supplies described in catalog. Page 273
A-1-285	Delta Power Tool Division, Rockwell Mfg. Co.	**Drill Presses**—Data on Delta Drill Presses contained in catalog; booklet available on "Delta Power Tools Teamed with Machine Tools." Page 285
A-1-233	The Dumore Co.	**Grinder**—Tool post grinders and other Dumore products described in Catalog 55 FL. Page 233
A-1-255	Ehrhardt Tool & Machine Co.	**Gages and Dies**—Booklet "Triple Plus" describes the Ehrhardt line of precision gages, dies and fixtures. Page 255
A-1-246-2	Elliott-Myers Corp.	**Measurement**—Brochure describes the EMscale for measurements to 1/10,000 of an inch. Page 246
A-1-15	Federal Products Corp.	**Indicators**—Operational data for Federal dial indicators contained in Catalog 55. Pages 14-15
A-1-61	The Fellows Gear Shaper Co.	**Gear Shapers**—"The Art of Generating with a Reciprocating Tool" gives engineering details. Page 61
A-1-201-1	The Gaertner Scientific Corp.	**Microscopes**—Bulletin 161-54 shows applications, models and specifications for toolmaker's use. Page 201
A-1-246-1	The J. C. Glenzer Co., Inc.	**Utility Tools**—Data Folder 1-A describes utility sleeves; Folder 1-D, live centers; and Folder 1-J, floating tool holders. Page 246
A-1-28	Geo. Gorton Machine Co.	**Milling Machines**—Bulletin 2699 describes new Gorton Mastermil and Catalog 2601-1655 describes the entire Gorton line. Page 28
A-1-267	Greenlee Bros. & Co.	**Automatics**—Catalog A-405 contains information on Greenlee automatic bar machines. Page 267
A-1-5	Hardinge Bros., Inc.	**Collets**—Bulletin 56 contains collet reference list for lathes, millers, grinders and fixtures. Page 5
A-1-197	Jarvis Corp.	**Tapping**—Bulletin describes Jarvis adjustable pitch lead screw tapper. Page 197

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Literature Number	COMPANY	DESCRIPTION	
A-1-158	Kearney & Trecker Corp.	**Special Machines**—Data Sheet No. 1044 describes new K&T 6-station rotary indexing milling machine.	Page 158
A-1-293	Krueger-Barnes Corp.	**Special Machines**—Booklet shows Krueger-Barnes special machine applications.	Page 293
A-1-200	The Lapointe Machine Tool Co.	**Broaches**—Data on "How to Care for Broaching Tools."	Page 200
A-1-262-1	Louis Levin & Son, Inc.	**Lathes**—Catalog M describes instrument lathes and accessories.	Page 262
A-1-181	Lincoln Gage Co.	**Gages**—20-page catalog illustrates and describes Lincoln Gages.	Page 181
A-1-289	Logansport Machine Co., Inc.	**Cylinders**—Catalogs on special installations available on request.	Page 289
A-1-272	Metal Carbides Corp.	**Carbide Metals**—Catalog 56-G contains data on Talide Metal.	Page 272
A-1-43	National Tool Co.	**Special Tools**—Catalog shows National Tool Co.'s line of special tools for the metal-working industry.	Page 43)
A-1-166	Nelco Tool Co., Inc.	**Cutting Tools**—Catalog describes over 700 carbide tipped cutting tools.	Page 166
A-1-51	Niagara Machine & Tool Works	**Power Shears**—Bulletin 69G describes new Underdrive Squaring Shear.	Pages 50-51
A-1-241	Norton Co.	**Grinding Wheels**—New catalog, Form 1052, gives general purpose information and describes wheel specifications.	Page 241
A-1-225	Oakite Products, Inc.	**Metal Preparation**—Booklets available describing Oakite products, they are: "Four Good Steps Toward Better Electroplating on Steel", "What's New for Electrocleaning Brass and Other Copper Alloys", "Good News About Electrocleaning Zinc-Base Die Castings."	Page 225
A-1-253	The Ohio Crankshaft Co., Inc.	**Induction Brazing**—"Typical Results of TOCCO Induction Brazing and Soldering" available in catalog form.	Page 253
A-1-243	The O. K. Tool Co., Inc.	**Milling Cutters**—Catalog 13 describes "Modern Milling Cutters for Modern Milling Machines."	Page 243
A-1-219	Ortman-Miller Machine Co.	**Cylinders**—Bulletin 101-A describes O-M Tie-rodless round line air and hydraulic cylinders.	Page 219
A-1-258-4	Petz-Emery, Inc.	**Indicators**—Catalog D describes Em-re line of dial indicators.	Page 258
A-1-54	Pines Engineering Co., Inc.	**Cold Bending**—Study data on production bending available in Pines News.	Page 54
A-1-257	The Pipe Machinery Co.	**Gages**—Illustrated catalog describes range of PMCo gages.	Page 257
A-1-65	The Producto Machine Co.	**Die Data**—Die set catalog No. 11 describes the Producto line.	Page 65
A-1-161	Sandvik Coromant Division, Sandvik Steel, Inc.	**Cutting Tools**—Illustrated catalog covers entire Coromant Line.	Page 161
A-1-207	Seibert & Sons, Inc.	**Special Tools**—Brochure illustrates and describes Seibert's line of holding and driving tools.	Page 207
A-1-185	The S-P Mfg. Corp.	**Cylinders**—Catalogs No. 110, 109-A and 104 give engineering specifications for S-P Cylinders.	Page 185
A-1-203-2	Standard Parts Co.	**Holding Components**—Catalog contains data on Standard line of jig and fixture hold down components.	Page 203
A-1-10	Standard Pressed Steel Co.	**Cap Screws**—Bulletin 2193 contains technical data and specifications on Unbrako socket head cap screws.	Page 10
A-1-64	Uddeholm Company of America, Inc.	**Tool Steels**—New tool steel stock list No. 12 available.	Page 64
A-1-264	U. S. Tool Co., Inc.	**Special Machines**—Bulletin 15-T contains specifications for U. S. Multi-Slide machines.	Page 264
A-1-270-3	Vaill Engineering Co.	**Forming Machines**—Bulletin T-1 describes Vaill tube end-forming machines.	Page 270
A-1-248	The Van Keuren Co.	**Gages**—Catalog and Handbook No. 36 contains technical engineering information on measuring problems and methods.	Page 248
A-1-247	Vanadium-Alloys Steel Co.	**Tool Steels**—WCC Data Sheet contains information on new tungsten, chromium, cobalt and vanadium hot work die steel.	Page 247
A-1-BC	Verson AllSteel Press Co.	**Press Brakes**—Catalog B-55 gives design details and specifications on Verson Press Brakes.	Page—Back Cover
A-1-211	Waldes-Kohinoor, Inc.	**Grooving Tool**—Manual contains information on Waldes Truarc grooving tool.	Page 211

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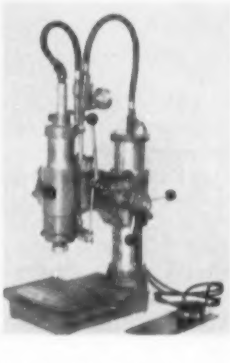
gears up to 4-diametral pitch with pitch diameters from 1 to 12 in.

Both models are available in three different types. Types 1 and 2 are universal machines that provide for conventional shaving of gears. Diagonal shaving with two-stroke or multi-stroke cycles can also be performed in conjunction with an automatic differential upfeed. Crown and taper shaving attachments are available on Type 1 machines. The third type of machine provides only for basic diagonal shaving with the two-stroke cycle.

National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. **T-1-1711**

Air Hammer

Single acting pneumatic impact machine, Model 300-VS, has variable stroke length and an impact range from 0 to 20,000 lb. An air traverse cylinder, actuated by a foot valve, lowers the hammer cylinder until the tool is firmly in contact with the work. An overtravel



in the linkage then trips the main valve and releases the hammer.

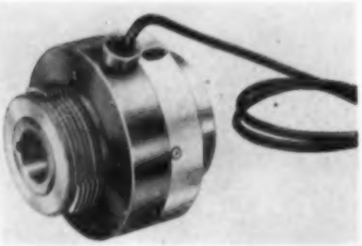
Clearance height is adjusted by a rack-and-pinion with handwheel. Height of the tool above the work at the start of the cycle has no effect on impact force.

The machine can be used for staking, riveting, impression marking in metal, pressure assembling, and similar operations.

Heidrich-Nourse Co., 631 E. Third St., Los Angeles 13, Calif. **T-1-1712**

Electric Clutches

Maxitorq electric floating disk clutch, in a full range of standard sizes in both single and double types, consists of a sealed magnetic coil enclosed in the clutch housing and acting through a sleeve and pressure plate to compress the clutch disks. The electromagnetic actuating mechanism is stationary. There is no mechanical contact between the moving and stationary parts. Entire



mechanism is essentially self-adjusting and self-compensating for wear.

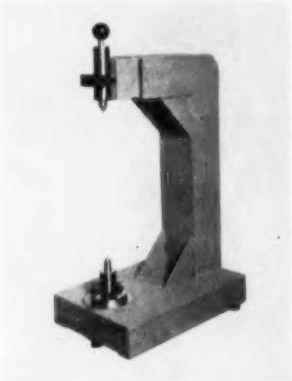
Clutch action, in combination with characteristics of the Maxitorq floating disk design, assures instant, positive engagement and disengagement to a point beyond the rated load-carrying capacity of the units. The magnetic flux and pressure exerted on the clutch disks can be precisely controlled by varying the voltage. The units may be used to pick up or slow down a load gradually from a remote station.

They can be furnished with either steel disks, usually running in oil, or with standard bronze-faced disks for dry applications. All sizes operate on 110-v house current, rectified to 90-v d-c current, and consume 80 watts.

The Carlyle Johnson Machine Co., Manchester, Conn. **T-1-1721**

Vertical Center

Parts are held vertically in the center illustrated, which is useful in checking runout on parts with large flanges, such as rotors, pump vanes and jet impellers. It is intended for use on a surface plate. The upper center is re-



tractable and is spring loaded. The lower center is flange-mounted and supports the workpiece. A three-point base pad is square with a line through the centers. Capacity between centers is 16 in. and swing is 21 in. in diam.

Industrial Gages, Inc., 201 N. Madison St., Rockford, Ill. **T-1-1722**

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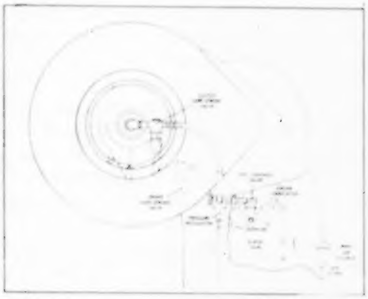
Press Safety Device

Saf-Strok Control is a safety device that prevents a press from "repeating" —a condition resulting from air, electrical or mechanical failure where the slide continues to stroke even though the run buttons have not been depressed.

When the crankshaft of the press accidentally overtravels 5 to 10 deg, a preset limit switch is activated, stopping the press. This is accomplished as follows: two 3-way solenoid valves are installed in the air line, one near the clutch, the other near the brake. Both valves are normally open, so that when the press is operating safely they have no effect on the machine. When the crankshaft overtravels, the limit switch energizes both valve coils simultaneously. The valves close and immediately exhaust the air from the clutch and brake, causing the clutch to

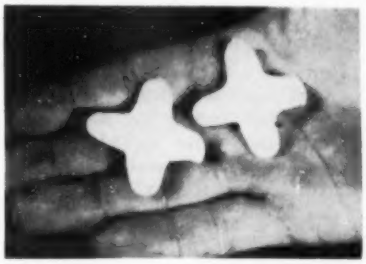


disengage and the brake to engage. The slide stops instantly.

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill. **T-1-1731**

Evaporation Barrier

Made of expanded polyethylene, Mini-Vaps float on the surface of volatile solutions, retarding evaporation losses as much as 75 percent. They are



designed to interlock and cannot be punctured or broken. Suggested applications include cleaning and pickling tanks, plating tanks, solvent and oil storage tanks.

American Agile Corp., P. O. Box 168, Bedford, Ohio. **T-1-1732**

Flying Press

Upper and lower platens of this coil-fed press move with the strip during the time in which work is performed. A set of feed rolls is synchronized with the motion of the dies. Stock is fed continuously rather than on a start-stop basis, thus permitting high strip speeds. Length of index is infinitely adjustable within a given range.

A mechanism is provided for lowering the bottom die out of engagement with the upper in a controlled sequence of operation, thereby multiplying the effective feed range indefinitely. The press has no clutch or brake. Bearings are lubricated by a pressure system.

The separate decoiler unit has been especially developed for use with the flying press. Two narrow face cones support the coil. These are incorporated

in large diameter disks which act as side guides. The disks, riding on two rollers, are brought into contact with the coil by a handwheel. A lift is provided to center the coil on the cones.

Leveling is accomplished by a set of entry pinch rolls and four work rolls incorporated in the decoiler. This leveler is motor-driven and feeds the strip into a loop in front of the press.

The press can be equipped for either

ac or dc operation. Manual operation is provided for die setting and strip jogging.

Nine different models are available ranging from 40 to 200 tons, accommodating coil widths from 14 to 48 inches, depending on the model. Speeds from 150 to 450 strokes per minute are available in different models.

Wean Equipment Corp., 22800 Lakeland Blvd., Cleveland 17, Ohio.
T-1-1741

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cutting Toolholder

Clamping type toolholder is intended for use with ceramic tools of the indexable "lozenge" insert variety. Body and clamp are precision machined and heat treated. The clamp provides even pressure over the entire length of the separate, removable chip breaker. A concealed hexagonal socket type adjusting screw works against the clamping screw to provide micrometer adjustment of the chip breaker. A raised shoulder on the underside of the clamp provides backing for the chip breaker, keeping its lead edge parallel with the cutting edge of the tool.

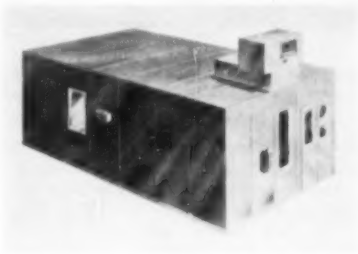
The clamp is kept in alignment by a second raised shoulder which fits into a matching groove in the face of the holder body. This shoulder has a triangular heel which bears on the bottom surface of the groove in the holder, acting as a rocker to permit the clamp to adjust itself to bear evenly over the full length of the chip breaker, thus compensating for variations in shim or chip breaker thickness.

Shank sizes are 1 x 1 in., 1 x 1¼ in. and 1 x 1½ in., right and left hand, for use with special ¾-in. square and ⅝-inch included-circle triangular turning, shoulder and facing tools, with negative, neutral and positive rake.

Diamonite Products Mfg. Co., Canton 2, Ohio. **T-1-1742**

Air Conditioned Booths

Providing a "packaged environment" for precision measurement, gage inspection and repair, jig boring and close-tolerance final assembly work, these air-conditioned booths are prefabricated. They will maintain a temper-



ature of 68 F., plus or minus 1 deg, and will hold relative humidity below 50 percent.

The booths range in size from 12 by 15 ft to 30 by 40 ft. Clear-span ceilings range from 8 ft 6 in. to 18 ft. There is an air lock in the entrance. The return air plenum serves as a soaking chamber to reduce the time needed to bring parts to gaging temperature.

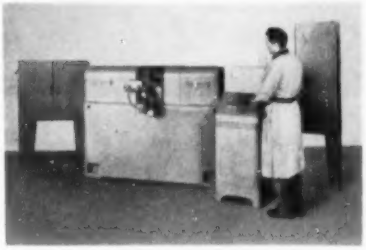
Agnew-Higgins, Inc., 40 S. Los Robles, Pasadena, Calif. **T-1-1743**

Gear Testing Unit

Gears in the ⅞ to 3 in. diam range can be electronically sound-tested in the equipment illustrated, which consists of a fully automatic magazine-feed, a separate control console and a

special circuit that prevents extraneous noises from causing gear rejection.

Gears are run in both directions in mesh with another gear, with and without brake loading, unloaded, and passed or rejected by the electronic sound discriminator unit, whose microphone is placed near the gear-mesh area. The discriminator can be adjusted to the



rate of audible noise frequency and intensity desired for rejection.

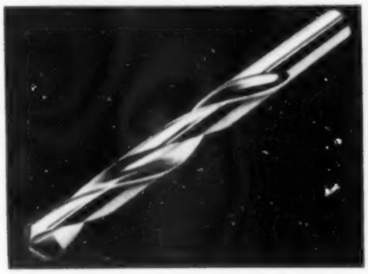
Push-button controls are included for each machine function. Air cylinders control work arbor, loader and brake functions. Separate electrical and pneumatic control panels are mounted away from the gear-mesh area to minimize noise levels.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

T-1-1751

Drills for Cast Iron

Series 333 carbide-tipped drills are intended for fast drilling of cast iron. A special fluting, heavy web and "slow"



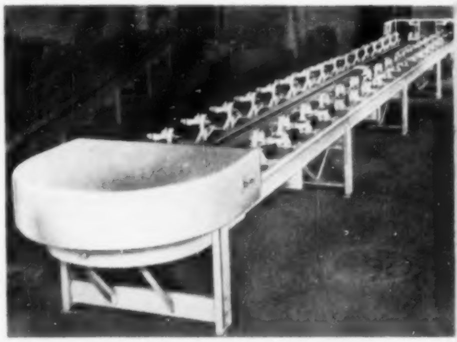
spiral provide tool strength and rigidity. Available in the 1/8 to 1/2-in. diam range in 1/64-in. increments, the drills are made to standard lengths.

Ace Drill Corp., Adrian, Mich.

T-1-1752

Conveyors

Conveymatic Carrousel platen conveyors, suitable for assembly, inspection or light machining operations, are available in any length, in 10-ft. multiples, up to 100 ft, with automatic accurate indexing and adjustable dwell for work cycle. Working height is 38 in., adjustable up or down 2 in. Width



is 4 ft and can be varied to specifications. Heavy-duty 10 x 12-in. carrier platens, drilled and tapped to customer specification, support up to 100 lb. They are on 12-in. centers. Entire top of conveyor is clear, permitting easy installation of drill units, hoppers, nut runners, etc. Input speed is adjustable from 200 to 600 ft per hr.

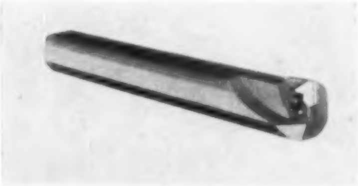
Power is supplied by a hydraulic indexing unit, which operates at 800 psi and is driven by a 2-hp motor.

The 40-ft Carrousel shown is tooled for the assembly of automotive transmission valve body assemblies. It has 86 carrier platens, of which 80 are always usable.

Visi-trol Engineering Co., 9345 Hubbell, Detroit 28, Mich. **T-1-1761**

Boring Bar

Triangular button inserts are used in a line of boring bars produced in sizes from $1\frac{1}{2}$ to $2\frac{1}{2}$-in. shank diam. The carbide inserts can be indexed and



turned to give six cutting edges. Inserts are available in $\frac{3}{8}$ and $\frac{1}{2}$-in. inscribed circles.

Kennametal Inc., Latrobe, Pa.
T-1-1762

Optical Height Gage

Intended for use on a surface plate, the optical height gage illustrated is capable of measuring heights up to 61 inches, with accuracies of plus or minus 0.000005 in. per in. of height. Essentially, it consists of a measuring microscope and a stack of gage blocks which are held by spring tension. The stack

is made up of alternate 0.300 and 0.700-in. blocks and is divided into 1-in. increments by protrusion of the 0.300 blocks beyond the 0.700 blocks.

By means of a lever-operated cam and a vernier adjustment handwheel, the stack of blocks is easily raised and lowered over a range of one in. to obtain fast settings of measurements to 0.000025 in. These are read in the eyepiece and are measured from the

top of the protruding gage block corresponding to the inch of height being measured. Measurements are transferred from this point to the work, or vice versa.

The base of the instrument is a heavy casting, supported on three hardened feet which slide on the surface plate. Optical elements are protected in the base and gage blocks are supported in cast iron and aluminum standards.

Weber Gage Co., 12912 Triskett Rd., Cleveland 11, Ohio. **T-1-1771**

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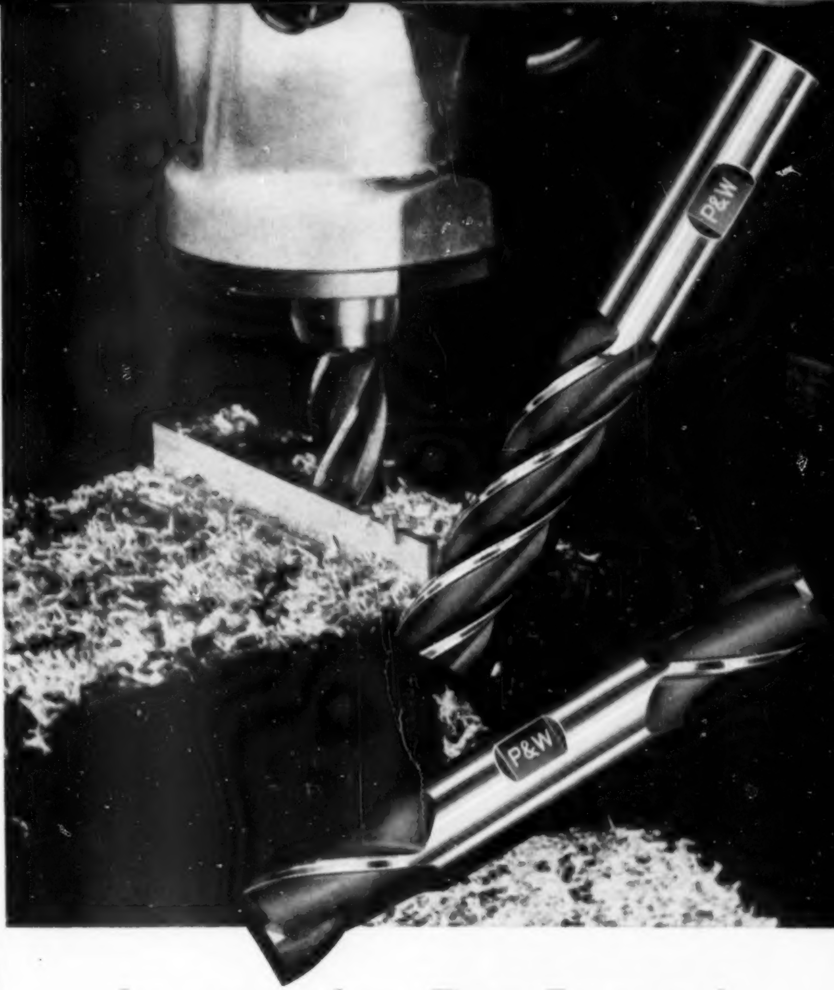
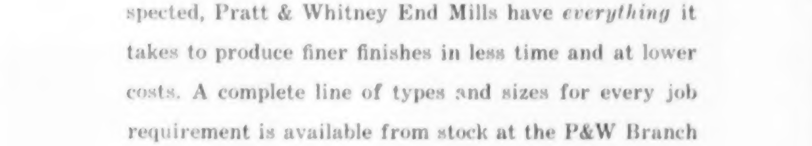
Automatic Drilling Unit

Drilling unit utilizing plate type cam gives rapid approach and return. The unit is completely enclosed and is lubricated by a Micro-Fog system, eliminating oil seals on all rotating surfaces, enabling it to be mounted in any position and to be lubricated automatically.

Linkages and gear segments are eliminated by using a solid cam roller follower which moves in a straight line in a hardened track. Cam leads can be faithfully reproduced in the spindle carrier movement. An air solenoid-operated feed clutch can be set to disengage at any desired feeding pressure so that the tool is not forced to the breaking point under excessive resistance. A single tool may be used in the spindle or a multiple head may be attached to the spindle carrier.

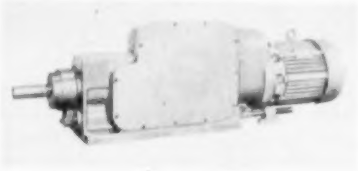
Motor drive is through gearing to





the spindle, and consists of an end-mounted standard-dimensioned motor, $\frac{3}{4}$ to 5 hp. The feed to the camshaft is through gearing mounted on the side of the case. An air-operated counter-balance actuates the return stroke. The spindle and cam drives utilize speed gearing with complete gear trains. Speeds and feeds can be changed by changing gears in the train.

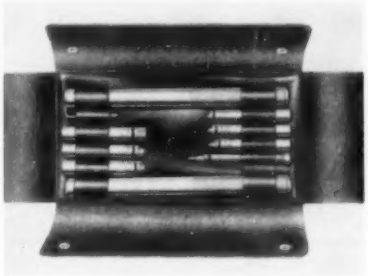
Maximum thrust is 1800 lb. Length



of stroke is six in. Spindle speeds range from 95 to 4000 rpm. The stroke cycle can be varied from $1\frac{1}{2}$ sec. to six min. Drills up to $1\frac{1}{2}$ in. in diameter can be accommodated.

W. K. Millholland Machinery Co., Inc., 6402 Westfield Blvd., Indianapolis 20, Ind. **T-1-1781**

Diamond Tool Kit

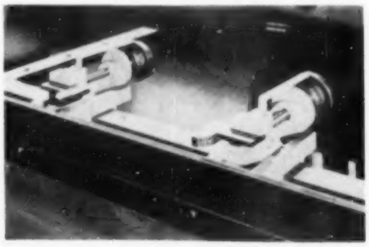


General purpose diamond tool kit contains seven tools, two toolholders and key in leather case. Kit is intended for use in small shops.

Abrasive Dressing Tool Co., 14528 2nd Ave., Detroit, Mich. **T-1-1782**

Press Brake Gage

Faster setup times are claimed for this press brake gage, which eliminates the use of clamps and makeshift set-



ups. Two or more of the gages are fastened to a $\frac{3}{4}$ x 2-in. bar in the rear of the press brake. Each unit is independent, with its own micrometer reading and locknut.

A scale is mounted on the side of the gage, with a pointer for reading the range of 0 to $3\frac{1}{2}$ in. The gage can be positioned along the $\frac{3}{4}$ x 2-in. bar at any point desired and locked in place with two special thumbscrews which will not mark up the bar.

Addresso Mfg. Co., 9015 W. King St., Franklin Park, Ill. **T-1-1791**

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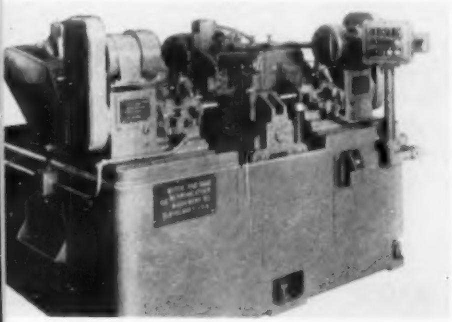
Milling and Centering Unit

This small, compact transfer machine for double-end milling and center drilling employs the in-line transfer principle. The unit is designed to meet lower production requirements. Opposed milling heads and drill heads are



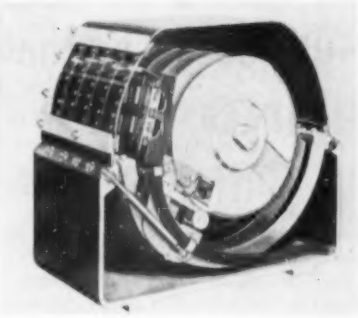
way-mounted on either side of a fixture table. Operation is automatic after the operator has loaded the fixture at the front of the unit. The fixture is hydraulically actuated for clamping.

The Motch & Merryweather Machinery Co., Machinery Mfg. Div., 888 E. 70th St., Cleveland 3, Ohio. **T-1-1792**

Cam Limit Switch

Cam limit switch with 15-amp contacts is designed for precise synchronization of multiple operations. The switch has a positive micrometer screw adjustment of each individual switch mechanism in relation to its cam. This adjustment can be made with a screwdriver, from the outside, while the switch is in motion.

The type "AL" switch is made in three standard sizes accommodating five, nine, or twelve cams. Cams can be set with a spread between circuit



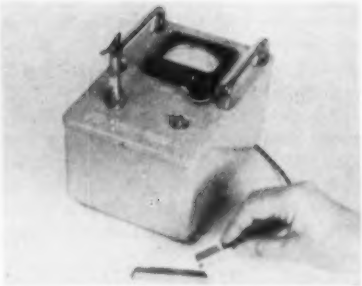
make-and-break of from 15 to 345 deg. with an external in-motion adjustment of plus or minus 15 deg.

Rotation can be either clockwise or counterclockwise, and the switch operates at speeds up to 100 rpm. Both fixed and moving contacts can be inspected from the outside through a transparent panel in the oiltight case.

Clark Controller Co., Cleveland 10, Ohio. **T-1-1793**

Surface Finish Gage

With this electronic instrument, surface finish in microinches can be determined by comparison or by direct measurement. It can be used on flat or round surfaces or holes. In operation, as a probe is stroked across the surface under test, a small radius sapphire stylus translates minute surface irregularities into an electrical signal which is amplified, corrected and



indicated on the meter of the instrument.

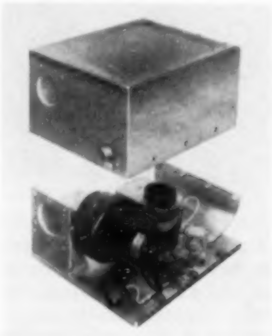
A special circuit is incorporated to minimize variations in reading due to differences in stroking speed. Readings can be taken in three ranges: 0 to 50 microinches, 0 to 100 microinches and 50 to 150 microinches.

Saratoga Scientific Corp., Box 488, Saratoga, Calif. **T-1-1801**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Ultrasonic Transducer

Air-cooled large-capacity magnetostrictive type transducer is recommended for dual mounting on produc-



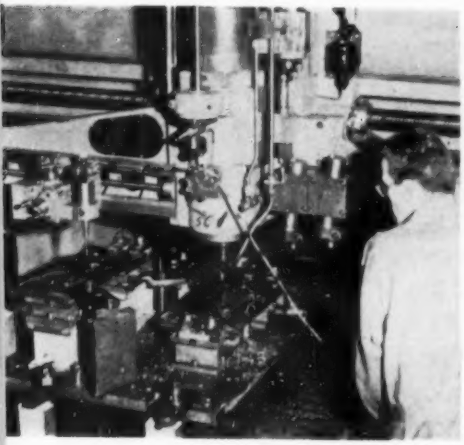
tion line tanks for ultrasonic cleaning of parts. It is used in conjunction with a cleaning solvent.

John B. Moore Corp., Nutley, N. J. **T-1-1802**

High-Speed Duplicator

Electronic-hydraulic tracer control machines, identified as E-Series Duplimatics, allow tracing at speeds up to 100 ipm as required by the airframe industry.

The units are available with two and three feed tracers and remote control rise-and-fall tracers. Features of these three-feed units are that they accomplish plane and depth control with a



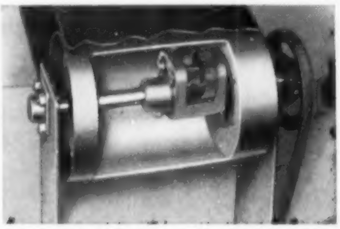
single probe.

The E-Series allows tracing within full range of the machine tool. Conventional operation of the machine tool is not restricted. Unimpeded use of all conventional controls is accomplished after installation by automatic pushbutton interchange.

This tracer control equipment can be supplied as original equipment on machine tools or may be installed on existing machines in the field. Natural frequency of the new or old machine tool can be predetermined and tracer performance predicted prior to installation.

Tracer Control Co., 595 E. Ten Mile Rd., Hazel Park, Mich. **T-1-1811**

Drive Pulley



Drive for conveyors has the gear reduction unit inside the pulley. With this drive, equipment can be narrower and without overhang on the drive side. Unit is permanently lubricated.

Bunke-Musser, Inc., Jackson Center, Ohio. **T-1-1812**

Dual Lubricator

Two independent lubrication systems, providing both cyclic and continuous oil flow to different bearings on the same machine, are built into a single automatic lubricator, designated the AP-3. It is intended specifically for machines where some bearings need periodic lubrication and others require oil continuously.

The lubricator consists of two independent gear pumps with a common drive gear, mounted on a single housing, both drawing oil from a common reservoir in the bottom of the housing. Each pump has its own inlet and outlet, feeding oil through separate distribution systems to the bearings it serves. Meter units at each bearing filter and measure exact quantities of oil fed to the bearing.

A cam-operated valve controls the

cyclic portion of the pump. Since the cam is adjustable, the frequency and duration of cycle can be varied. Cyclic pressures can be as high as 150 psi or as low as 25 psi, depending on requirements of the machine being lubricated.

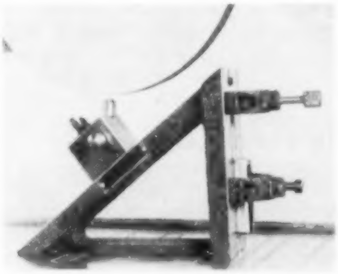
The continuous portion of the lubricator is fed by a constant volume pump through its own passageway and tubes inside the lubricator to the distribution system. Operating pressures range from 7 to 50 psi.

Bijur Lubricating Corp., 151 W. Passaic St., Rochelle Park, N. J.

T-1-1831

Adjustable Wheel Dresser

Height of this grinding wheel dresser, intended for use with surface grinders, is adjustable, so that there is no necessity to move the grinding wheel itself



for dressing. It can be used on either magnetic or nonmagnetic chucks. A holder attachment makes it possible to grind small tools and punches to uniform height.

Dover Machine Sales Co., 140 Dover St., Boston, Mass. **T-1-1832**

Magnetic Plate Handling Attachment

Magnetic attachment for fork lift trucks is mounted between the forks of an electric truck. It operates automatically when a control switch on the cowl of the truck is placed in the "on" position. Turning the switch off

permits regular fork handling. The action of the magnet prevents the load from slipping or tipping.

Yale materials Handling Div., The Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.
T-1-1841

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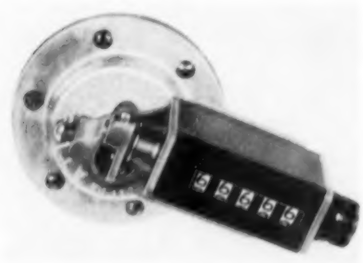
Automatic Counter

Designed for use for any operation controlled by pneumatic or hydraulic action, this counting device is screwed into any air or hydraulic cylinder.



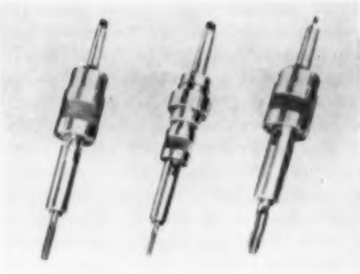
Models are available for from 1 to 5000 psi and up to 300 counts per minute. All models are available with five or six digits and knob or key reset.

Pneumaticount, 3400 N. E. 54th Ave., Portland, Ore. **T-1-1842**

Tap Drivers

Part of an expanded line, three styles of tap drivers are being offered: tension-and-compression type, quick-change type, and heavy-duty type. All drivers feature an overrunning roller drive design that releases instantly and completely when a preset torque is reached. Torque is transmitted when the rollers are wedged between the drive shell and raised cams on the drive collet. All parts deform elastically when rollers climb into wedging position. When torque reaches the preset point, the rollers roll past the high points on the cam and are locked in a "free" position. In this position, no torque is transmitted from drive to tap.

The tension-and-compression type tap drivers compensate for variations in feed between spindle and tap and release at preset torque rating when the hole is tapped. Two sizes are offered



for taps from No. 10 to $\frac{5}{8}$ in.; torque ranges from 50 to 700 in.-lb.

The quick-change type tap drivers are shorter and have a smaller diameter than other drivers of the same capacity. Three sizes are available for tap ranges from No. 10 to 1 in. Torque range is from 40 to 1900 in.-lb.

The heavy-duty tap drivers have a double-roller design. The two sizes available cover a tap range from $\frac{1}{2}$ to $1\frac{1}{2}$ in. and torque range from 500 to 2400 in.-lb.

Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill. **T-1-1843**

Hardness Gage

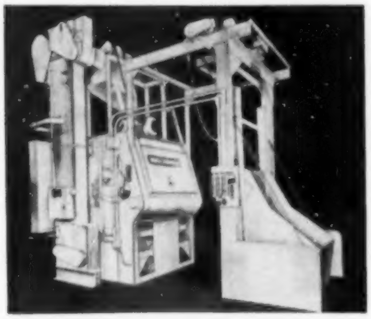
Model A hardness gage indicates hardness of rubber and plastic materials in durometer units. The gage has a hardened steel indenter which comes in contact with the material being

tested. This indenter pushes up the runner of a vernier by direct contact. The runner is then held by friction so that the instrument can be removed and read elsewhere. Readings can be made to 1 durometer point.

W. F. Orth, 802 S. Ada St., Chicago 7, Ill. **T-1-1844**

Blast Cleaner

Batch-type abrasive blast cleaning machine is for work that can withstand a tumbling action. It has a capacity of 14 cubic ft. A large-capacity abra-

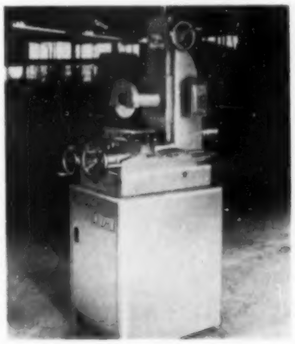


sive-hurling wheel throws 830 lb of abrasive per min. Two abrasive separators are available: one for foundry applications and another for less exacting jobs.

Wheelabrator Corp., Mishawaka, Ind. **T-1-1851**

Surface Grinder

Improved hand feed surface grinder will accommodate standard wheel adapters. Transverse travel is 7 in. and working height under a standard 7-in. diam wheel is $12\frac{1}{4}$ in. Prepacked



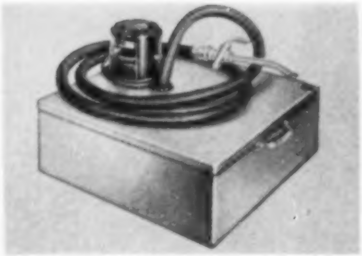
spindle bearings eliminate the need for spindle lubrication. Power is supplied by either $\frac{1}{2}$ or $\frac{3}{4}$-hp motors. The machine is available either with or without the cabinet.

Harig Mfg. Corp., 5759 W. Howard St., Chicago, Ill. **T-1-1852**

Medium-Duty Coolant Pump

Model 505-T coolant pump and tank is self-contained and is designated for either permanent or portable coolant supply for small and medium-size machine tools. Weighing 27 lb, it can pump from one to 500 gpm of light mineral or soluble oils to the work. Heavier fluids can also be used at lower pumping rates.

The unit is equipped with a built-in baffle to remove chips and abrasive

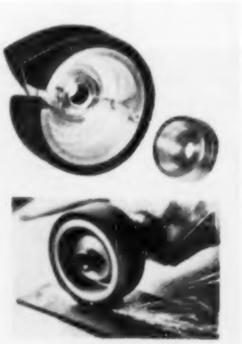


particles. Tank capacity is 6 gal. The standard pump operates on 115-v, 60-cycle, single-phase current and can also be supplied for use with 230-v, 60-cycle, single-phase current.

The Brady Pump Corp., Muncie, Ind. **T-1-1861**

Sanding Wheel

Split-drum sander, available in $1\frac{1}{2}$-in. width with arbor hole diameters of $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in., weighs 1 lb. Drum diameter is 4 in. The wheel utilizes strips of coated abrasives which can be torn off standard abrasive rolls. It is



suitable for grinding, buffing and polishing operations with portable high-speed-grinders, and can be operated at 6000 rpm. The rubber cushion is 50 durometer neoprene rubber.

American Diamond Saw Sales, 120 N. W. Ninth Ave., Portland 9, Ore.
T-1-1862

Internal Measuring Instrument

An electronic gaging system is incorporated in a shop and laboratory instrument for inspecting internal diameters of ring gages and other parts for size, taper, bellmouth and out-of-roundness. Standard capacity is from 0.370 to 12 in. with vertical capacity to $1\frac{1}{2}$ in. Special gaging arms can be obtained to provide gaging range from 0.240 to 12 in. with vertical capacity to 1 in.

Essentially, the instrument consists of a heavy serrated gage plate, vertically adjustable, on which the workpiece is placed. Gaging contact is provided by two vertical reed-mounted gaging arms with diamond points, which are elevated into the workpiece. The gaging arms are set to the dimension to be checked with gage blocks.

The instrument is available with dual electronic amplification of 1000/2000, 2500/5000, 5000/10,000 to 1. Amplifi-

cations within each dual range can be switched from one to the other without realignment of the indicating meter mechanism. With 5000/10,000 amplification, direct readings to 0.000010 can be made.

Both bench and floor models are available. Power requirement is 110-v, 60-cycle ac.

The Sheffield Corp., Dayton 1, Ohio.
T-1-1871

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Screw Machine Tap

A stub tap manufactured specifically for use in screw machines is shorter in length than conventional taps and has a necked shank for improved lubrication. Other features are a spiral point to reduce torque and improve chip dis-

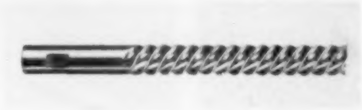
posal and a short thread length to counteract any tendency to produce bellmouthed threaded holes because of misalignment.

The taps are available from stock in high-speed steel ground thread, NC or NF, plug or bottoming chamfer, in Nos. 2 to 10 machine screw sizes.

Pratt & Whitney Co., Inc., West Hartford, Conn. **T-1-1872**

Push Broach

Dual-purpose broach, available as a stock item, can be used as conventional push broach in punch presses or lathes, or as rotary broach for machines in which the tool or the workpiece ro-



tates. Multiple-spiral flutes provide a continuous cutting action. Resharpening can be accomplished on a tool or cutter grinder, with only one setting required. The tools are carried in sizes from 1/8 to 1-in. diam in increments of 1/32 in.

Shearcut Tool Co., 7045 Darby Ave., Reseda, Calif. **T-1-1873**

Drill Sleeve

Expendable nylon drill sleeve will break when drill runs into hard spots, air holes or similar defects which would normally break a drill. The nylon is

cured so that it is hard enough to stand up under normal drilling conditions. It absorbs shock and vibration and is unaffected by coolants.

James Products Co., Mentor, Ohio.
T-1-1874

Turret Drilling Machine

Model A-50 turret drilling machine is designed for performing consecutive drilling, reaming, counterboring and tapping operations with one handling of the work. The circular machine table accommodates rotary fixtures up to 48 in. in diameter.

The machine turret carries six spindles which work on a common axis and are indexed into position as required. Speed, depth and reversals for tapping are preset for each spindle and repeat automatically as the turret is indexed.

The workpiece is loaded in a rotary fixture and indexed from one hole location to another, all necessary operations being performed at each hole location by indexing the turret. This procedure minimizes handling time.

The quill is counterbalanced for extreme sensitivity and provides six inches of travel. The machine head is sepa-

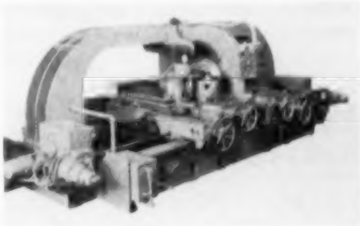
rately counterbalanced and adjustable through fifteen inches of travel.

Howe and Fant, Inc., 20 Fitch St., East Norwalk, Conn. **T-1-1875**

Facing Lathe

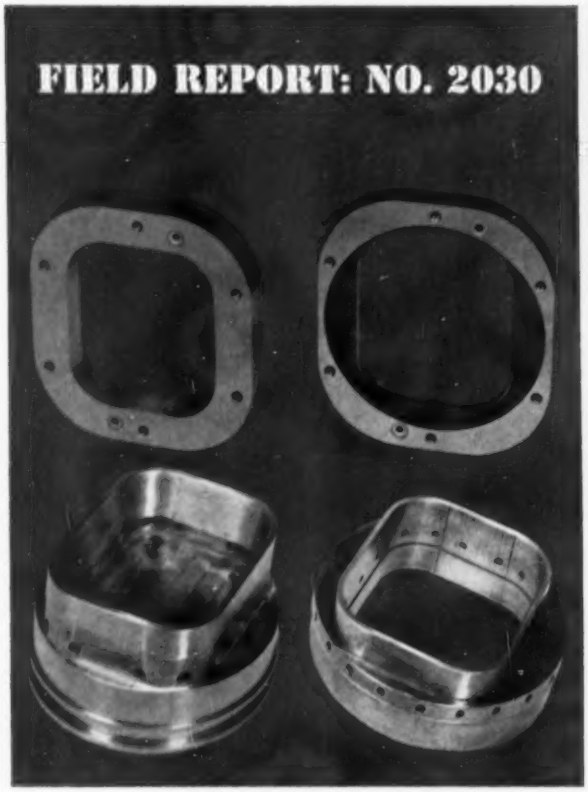
Designed for profile facing such parts as turbo-jet engine disks with up to 44-in. OD, this Model CDF center-drive facing lathe is available in six sizes. Cutting tools mounted directly on opposite sides of the workpiece turn both sides simultaneously. Rough, semi-finishing and finishing passes have been made on parts having a 22-in. diam and a thickness of 0.0029 in. Parallelism was within 0.001 in.

An electric system controls the feed motors in such a manner as to maintain proper balance through the complete cycle. The spindle speed control



for constant surface speed at any pick-off is achieved by a cam-controlled, variable-speed drive unit.

Wickes Machine Tool Div., The Wickes Corp., Saginaw, Mich.
T-1-1876



WHICH DIE STEEL WOULD YOU USE

to get "skin-fit" mating—250 million output?

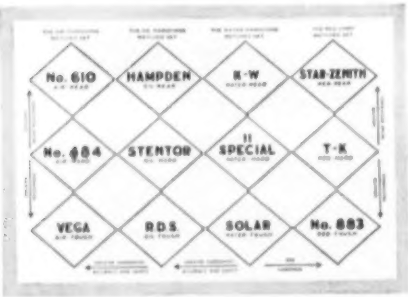
These dies for trimming .003" thick aluminum foil food containers presented the toolroom with this really tough set of tool and die requirements: Make the dies all in one piece . . . finish them to actual size before hardening . . . provide "skin-fit" mating after hardening with no finish grinding . . . and build the dies for multi-million production.

Suppose the decision on which die steel to use were up to you. Would you risk your reputation on any other steel than the one this toolroom decided to use?

Carpenter VEGA (Air-Tough) Die Steel came through with this remarkable performance: After hardening, the toolmaker discovered that the two die sections and two draw rings held to .0003"/.0004" overall . . . not just per inch. No finish grinding was necessary . . . a perfect "skin-fit" was assured. Machining the dies from a solid bar of die steel eliminated the need for welded or bolted sections.

The two VEGA rings are engineered to produce a staggering 26 million pieces before any grinding modifications . . . and a total production of 250,000,000 pieces. This Report is one of hundreds based upon actual plant records to prove conclusively the improved results obtained with Carpenter Matched Tool and Die Steels.

When will you join the growing number of plants who are enjoying better, lower-cost results? It will pay you to call Carpenter—get in touch with your nearest Carpenter Mill-Branch Warehouse, Office or Distributor today.



® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

FIELD notes

The recently established National Technical Training Services, 260 Delaware Ave., Buffalo, N.Y. has secured rights for publication and sale of a correspondence course, "Welding Fundamental Principles and Practices," originally developed by the Canadian Welding Bureau. The course, which has been brought up to date and revised where necessary to conform to current U.S. practices, includes welding methods, procedure control, distortion control, weldability, welding metallurgy, design, inspection, materials and equipment, estimating and costs and economies.

awards

Prizes totalling $25,000 are being offered in a competition sponsored by the James F. Lincoln Arc Welding Foundation. Awards will be made for the 26 best papers describing the design of welded machines used in construction, mining, and certain process industries, and for jigs, fixtures and tooling in all types of industries. Details are available from the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

name change

Swanson-Erie Corp. is the new name of Swanson Tool & Machine Products, Inc., Erie, Pa. There are no changes in the company's organization, policies, services, or products.

corporate changes

Crucible Steel Co. of America has acquired the entire interests of National Research Corp. in Vacuum Metals Corp., which now becomes a wholly owned Crucible subsidiary. Plant and facilities are at Syracuse, N. Y.

√ √ √

The extrusion plant of the Hokin Aluminum Co., located at Dolton, Ill., has been acquired by Kaiser Aluminum & Chemical Corp. as part of its program for expansion of extrusion operations in the Midwest.

Controlling interest in Abrasivos Irmaos Meyer, S. A. of Sao Paulo, Brazil, has been acquired by Norton Co., Worcester, Mass. This will be the second Norton plant in South America.

√ √ √

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., has acquired the Sendzimir Cold Rolling Mill interests of the Armzen Co. Waterbury Farrel has been the principal manufacturer of Sendzimir cold rolling mills for the past 15 years, under license from Armzen.

√ √ √

Announcement has been made of the acquisition of Detroit Power Screwdriver Co., Detroit, Mich. by Link-Belt Co., Chicago, Ill. Detroit Power Screwdriver, a manufacturer of automated assembly equipment, will continue under its present management.

√ √ √

Formation of an Industrial Equipment Div. has been announced by United States Dynamics Corp., Boston, Mass. The division was formed for the manufacture of a line consisting of atmosphere and vacuum furnaces, carbon firing equipment for furnaces, demineralizing equipment, cation exchange units, gas drying equipment, and dry boxes and accessories for controlled atmosphere studies.

√ √ √

Union Twist Drill Co. of Athol, Mass. has purchased major controlling interest in R. Stock & Co., West Berlin, Germany and its subsidiary, Hartex Machine and Tool Works, also of West Berlin. Stock manufactures twist drills and other metal-cutting tools, and Hartex manufactures several types of precision grinding machines.

√ √ √

In order to diversify its operations, the R. K. LeBlond Machine Tool Co. has purchased the Fosdick Machine Tool Co., Cincinnati, Ohio. The Fosdick firm manufactures drilling, precision jig boring and grinding equipment.

√ √ √

The Louis Berkman Co. has sold its Ohio River Steel Division Plant, Toronto, Ohio, to Titanium Metals Corp. of America, New York, N. Y. The 400,000-square-foot plant will be converted to rolling and forging titanium.

√ √ √

Minneapolis-Honeywell Regulator Co. has purchased Davies Laboratories, Inc. of Beltsville, Md., manufacturer of specialized high-speed data recording systems. Activities of Davies Laboratories will be integrated with those of Honeywell's Industrial Div. in Philadelphia.

new facilities

Electronic components and systems are being produced by United States Dynamics Corp. in a new 20,000-square-foot building in Boston, Mass. Research and development facilities are housed in the same building.

√ √ √

Arthur Colton Co. has expanded floor space in its Mancelona, Mich. plant 20 percent. The plant produces rotary and single-punch tablet press punches and dies.

√ √ √

New facilities for flattening and tinning of alloy wire have been completed by Little Falls Alloys Inc., Paterson, N. J., manufacturers of nonferrous wire for special applications.

√ √ √

Manufacturing operations have begun at the recently completed plastics plant of Sylvania Electric Products, Inc. in Warren, Pa. Floor space is 110,000 feet. The plant will be operated as part of the Sylvania Parts Div. which also operates a newly acquired plant in Titusville, Pa.

√ √ √

The Sterling Die Div. of Pratt & Whitney Co., Inc., has completed its move to a new plant location in southwest Cleveland. The move more than trebles the manufacturing facilities of this division, which manufactures thread rolling dies.

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A 30,000-square-foot plant has been completed by Ledeen Mfg. Co. in El Monte, Calif. The plant is used for the manufacture of valves, cylinders, valve actuators and air-hydraulic pumps and boosters.

√ √ √

Chicago Flame Hardening Co. has opened a new plant in Chicago. Services of the plant include flame hardening of steel and cast-iron tools, gears and machine ways.

√ √ √

George L. Nankervis Co., designers and manufacturers of special test equipment for the automotive and aircraft industries, has occupied a new 90,000-square-foot plant in northwest

Detroit. The plant houses manufacturing activities, plus separate laboratories for electronics, instrument research and development, and electrochemical analysis.

√ √ √

A $500,000 machine tool replacement and modernization program will shortly be completed by M. P. Heinze Machine Co., Chicago, Ill., a designing and manufacturing firm.

expansions

Timken Roller Bearing Co. plans to construct a $500,000 Metallurgical Research Laboratory at Canton, Ohio. In addition to metallurgical research equipment, the building will house a metallurgical laboratory and a metallography laboratory. Approximately 75 metallurgists will use the new facility, which will have 1800 square feet of floor space.

√ √ √

A switchgear distribution apparatus plant is being constructed at Bloomington, Ind., by Westinghouse Electric Corp. The plant will be located on a 148-acre site and will employ 450 persons. Products will include capacitors and lightning arrestors for electric utility distribution systems, and cutouts and oil type reclosers for medium-voltage distribution systems.

√ √ √

A $2,500,000 five-year expansion program has been initiated by Aro Equipment Corp., Bryan, Ohio. Most of this investment will be for machine tools and other new equipment for Aro's Aircraft, Air Tool and Lubricating Equipment divisions.

Universal-Cyclops Steel Corp. is installing an inert-atmosphere pilot plant to fabricate molybdenum metal at its Bridgeville, Pa. research and development center. This facility will be unique in that it will make possible the fabrication of refractory metals in a completely enclosed room, at temperatures ranging from 3500 to 4000 F.

√ √ √

Fort Washington, Pa. has been selected as the location for a new 120,000-square-foot building to house the manufacturing, sales, research, development and administrative facilities of Minneapolis-Honeywell Regulator Co.'s Valve Div. The plant, on a 25-acre site, is designed to employ 1000 persons in the manufacture of hydraulic, pneumatic and electric industrial valves for use in automatic control. Minneapolis-Honeywell has also announced plans for construction of a $500,000 building for the production of electronic air cleaning equipment and other specialized metal products, to be located in Wabash, Ind.

licenses

Pheoll Mfg. Co., Chicago, Ill., has licensed Central Screw Co., also of Chicago, to manufacture its self-tapping, self-locking stud.

new companies

A. O. Smith Corp., Milwaukee, Wis., has announced formation of a wholly owned subsidiary, the A. O. Smith Engineering Service Corp. The new company, which is located in Milwaukee, supplements the engineering programs now carried out by the twelve operating divisions of the parent corporation.

√ √ √

The Nucledyne Corp., Chicago, Ill., has been formed as a subsidiary of the Cook Electric Co. The new corporation will specialize in engineering, designing and installing environmental testing equipment, radiation test facilities and similar projects.

√ √ √

A new high-strength aluminum bronze alloy will be produced for the first time in the United States by Superston Co. This company was formed by American Brake Shoe Co., New York, N. Y.; Ampco Metal Inc., Milwaukee, Wis.; and J. Stone & Co. (Holdings), London, England.

√ √ √

A line of air and hydraulic cylinders will be produced by Hydair Cylinder Corp., Cudahy, Wis. Other products of the company are boosters, accumulators and special cylinders.

TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 169

Epoxy Resin Adhesives

Eleven-page technical bulletin "Introductory Engineering Data on 3M Epoxy Resin Adhesives" gives engineering data on high-strength epoxy resin adhesives for metal-to-metal bonding and honeycomb sandwich construction. Five individual adhesives are discussed. Adhesives and Coatings Div., Minnesota Mining and Mfg. Co., 423 Piquette Ave., Detroit 2, Mich. **L-1-1**

Abrasive Selection

Characteristics, applications and selection of blast cleaning abrasives are covered in 12-page illustrated Bulletin No. 333. Illustrations show typical installations of blast cleaning equipment and a series of photomicrographs demonstrates differences between shot and grit blasted surfaces. Pangborn Corp., Hagerstown, Md. **L-1-2**

Automatic Lathe

Illustrated 24-page technical Bulletin No. 1808 gives description of Model 21 Mona-Matic Lathe, plus information on the machine's programmer control system, air-gage tracer mechanism, constant surface cutting speed control and optional automation system. Request only on business letterhead from The Monarch Machine Tool Co., Sidney, Ohio. **L-1-3**

Apprentice Training

Booklet "Apprentice Training—An Investment in Manpower" explains, in non-technical language, the aims, organization and operation of the national apprenticeship program. Copies available free of charge from the Publications Branch, Bureau of Apprenticeship, U. S. Dept. of Labor, Washington 25, D. C. **L-1-4**

Controls

Illustrated booklet, No. GEA-6372, 32 pages, covers operation and application of general purpose controls; what each product is, how it works and where it can be applied. Products include manual and magnetic starters, reduced-voltage starters, push buttons, relays, limit switches, solenoids, pressure and vacuum switches, float switches, plugging and antiplugging switches and a pressure governor. General Electric Co., Schenectady 5, N. Y. **L-1-5**

Thread Rolls and Holders

Thread Roll Bulletin 1-16 offers information to aid user to select standardized thread rolls and holders for single roll applications from stock; includes dimensional drawings and lists for equipment covered. Reed Rolled Thread Die Co., Worcester 1, Mass. **L-1-6**

Wicking

Illustrated, 8-page brochure describes Permawick, developed to permit high-speed wicking and oiling of sleeve bearings in a single automatic operation; explains product and equipment, application and advantages. Fluidwick Co., 5319 E. Outer Dr., Detroit 34, Mich. **L-1-7**

Fluid Drives

Illustrated Bulletin No. 9119 describes fluid drives for ½ to 25-hp applications. Performance curves compare starting torque, starting current and heat generation characteristics of a general-purpose a-c motor connected directly to a load with those of a similar motor utilizing fluid drive. Each of three available fluid drive types is discussed and selection tables, installation drawings and ordering information are included. American Blower Corp., Detroit, Mich. **L-1-8**

Assembly Machine Tooling

Bulletin No. 500 describes applications of standard rotary or in-line automatic assembly machine bases; well illustrated. Ferguson Machine Corp., Hicks Development Div., P.O. Box 350, Lebanon, Ind. **L-1-9**

Diamond Wheels

Illustrated catalog, No. 717, 32 pages, describes a line of metal and resin bonded diamond wheels and tools. Delta Diamond Wheel Corp., 1403 Utica Ave., Brooklyn 3, N. Y. **L-1-10**

Management Bookshelf

Booklet "AMA Management Bookshelf" is a complete catalog of publications of the American Management Association. Books listed deal with management performance, principles and practice. Request only upon company letterhead. Publication Service, American Management Association, 1515 Broadway, New York 36, N. Y.

Industrial Furnaces

Twenty-seven industrial furnaces are described in an illustrated bulletin No. SC-175. These range in size from small laboratory furnaces to large continuous brazing furnaces. Surface Combustion Corp., Toledo 1, Ohio. **L-1-11**

Screw Machine Production

Four-page folder describes company's complete services for design, development and manufacture of screw machine products and cold upset parts; also lists secondary operations available, machine capacities and background information on the company. The Chicago Screw Co., 2701 Washington Blvd., Bellwood, Ill. **L-1-12**

Collapsible Taps

Revised Bulletin No. G-95 covers receding chaser collapsible taps, style "LL," available in four sizes of tap bodies with detachable heads. Landis Machine Co., Waynesboro, Pa. **L-1-13**

Die Casting

Zinc die casting methods are explained in a new booklet, "Die Casting with Zinc Base Alloys," 31 pages. Factors influencing the production of sound castings, such as the maintenance of proper alloy temperature and the rates of heat input and withdrawal during a casting cycle, are discussed. Gating, venting, injection pressures and inspection techniques are covered. This booklet is intended primarily for machine operators. Available in quantities for distribution by plant managers from Henning Bros. & Smith, Inc., 91-127 Scott Ave., Brooklyn 37, N. Y. **L-1-14**

Switches and Relays

Eleven-page catalog gives complete information on a line of approximately 40 standard size and miniature switches and relays. Service Dept., Jaidinger Mfg. Co., 1921 W. Hubbard St., Chicago, Ill. **L-1-15**

Taps, Drills, Gages

Information on a line of standard and special taps, drills and gages is contained in Catalog No. 56-1. Six pages. Beloit Tool Corp., 12000 Milwaukee Rd., Beloit, Wis. **L-1-16**

Press Equipment

Bulletin ML-172 describes complete line of package applications for modernization of machinery with pneumatic clutch and brake. These Standardized Press Application packages, consisting of clutches, brakes, timing Rotorseals, high-speed clutch controls and flywheels, are ready to install after simple machining of crankshaft end. Bulletin contains data to aid in selection, and dimensions and flywheel inertia information. Fawick Airflex Div., Fawick Corp., 9919 Clinton Rd., Cleveland 11 Ohio. **L-1-17**

V-Belts

"V-Belt Drive Engineering Manual," 66 pages, covers V-drive selection, V-drive design and general information of interest to users and designers. Booklet contains extensive tables. Maurey Mfg. Corp., Publications Div., 2915 S. Wabash Ave., Chicago 16, Ill. **L-1-18**

Chain Couplings

Specifications, dimensions, rating and application suggestions covered in illustrated, 16-page catalog on series DSC and SA flexible chain couplings and series DRC roller chain couplings; also includes general information explaining purpose and function of flexible chain couplings. Morse Chain Co., Industrial Sales Div., Ithaca, N. Y. **L-1-19**

Hydraulic Equipment

Engineering information on reservoirs and hydraulic pumping unit accessories presented in detail and illustrated brochure; includes dimensional data sheets. Century Hydraulics, Inc., 7703 Lyndon Ave., Detroit 38, Mich. **L-1-20**

Analysis of Plating Solutions

"Simple Methods for Analyzing Plating Solutions," ninth edition, is a 36-page illustrated bulletin outlining in detail the necessary steps involved in 28 analytical methods for testing nickel, copper, silver and other metal-finishing solutions. Analytical principles, use of apparatus and methods for sampling a plating solution are covered. Equipment requirements, component chemicals, atomic weights, acid concentrations, electrochemical data and conversion tables are also included in the bulletin. Hanson-Van Winkle-Munning Co., Church St., Matawan, N. J. **L-1-21**

Drill Bushings

Installation procedure and pertinent engineering data are included in 12-page Bulletin No. DB-855, listing self-clinching template drill bushings. Penn Engineering & Mfg. Co., Doylestown, Pa. **L-1-22**

Precision Lapping

Use of fine diamond abrasives for precision lapping and fine microfinishing is described in a 28-page multicolor manual "The Technology of Precision Lapping." Covers methods of lapping cutting tools, dies, gages, precision wear parts and similar workpieces. Penn Scientific Products Co., 1000 Old York Rd., Abington, Pa. **L-1-23**

Box Furnaces

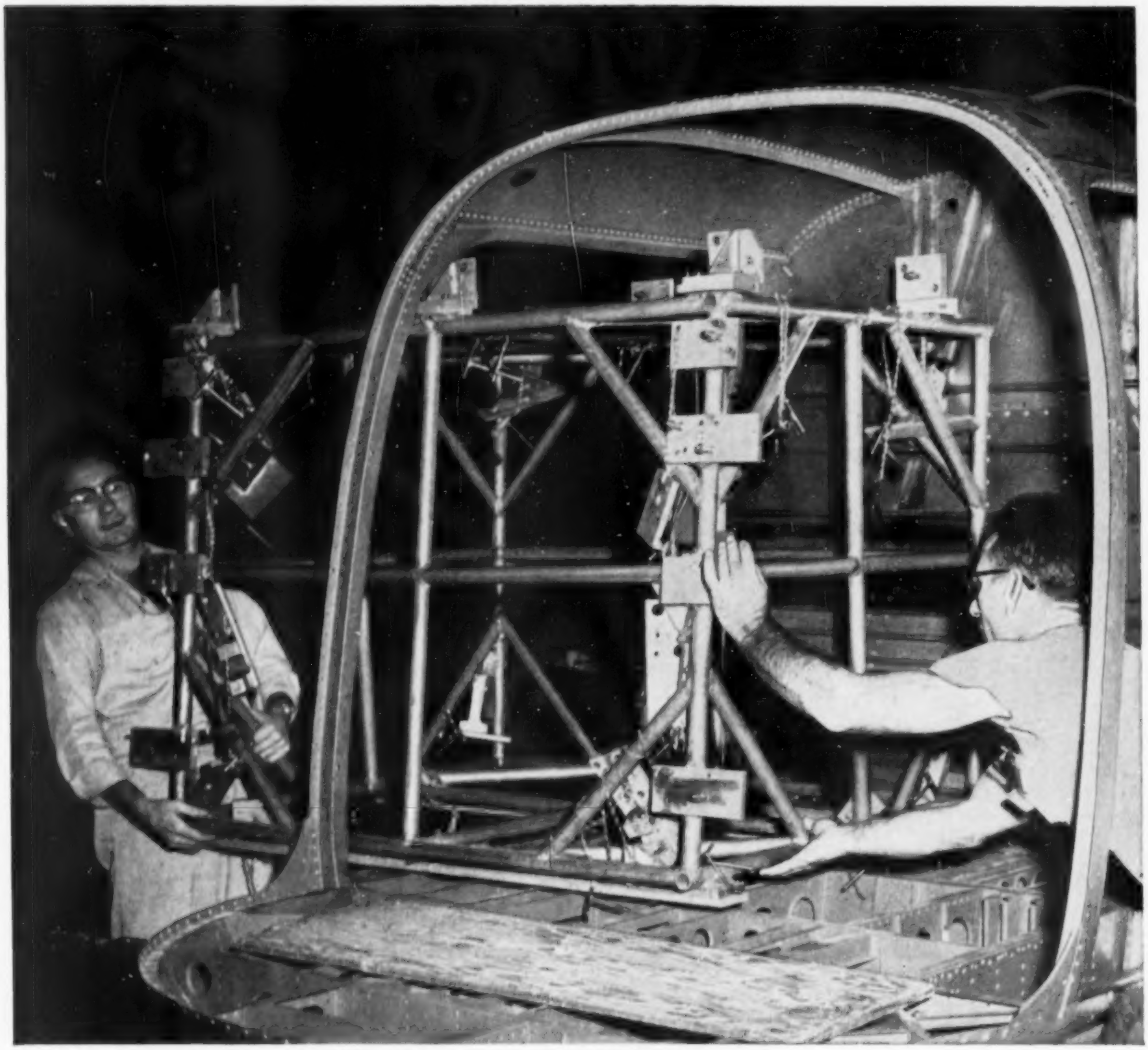
Bulletin No. GEC-1402, four pages, includes specifications, temperatures, ratings and dimensions of box type furnaces with cooling chambers for low production and laboratory applications. General Electric Co., Schenectady 5, N. Y. **L-1-24**

Data Processing Instruments

Informative 32-page general catalog of instruments for analysis, control and data processing explaining their function, application and advantages. Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif. **L-1-25**

Forging

Condensed 8-page booklet, "What is a Forging?" describes how forgings are made and various uses for them; follows development of the process from early times to present methods; written in nontechnical terms for easy understanding. Drop Forging Assn., 419 S. Walnut St., Lansing 33, Mich. **L-1-26**



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

Magnesium for accuracy

"Lightweight tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415U.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

Men at Work

Two major appointments have been announced by National Research Corp. **S. Sydney Minault** has been named vice president of the corporation and **Philip J. Clough** has been appointed director of the metallurgical research department.

Donald C. Erdman, former president of Electro Circuits, Inc., has been appointed assistant to the president, Sperry Products, Inc. He has extensive experience in the development and application of ultrasonic testing for quality control. He is a recipient of the A. V. De Forest Award for outstanding contributions to the field of nondestructive testing.

J. P. Arndt Jr. has been appointed assistant to the vice president and general sales manager of Brush Electronics Co., Div. of Clevite Corp. He will concentrate his activities on product planning and development.

LaSalle Steel Co. has announced that **T. Lloyd Kelly** has been elected chairman of the board. **Thomas A. Kelly**, former executive vice president, has been named president and chief operating officer.

Tell Berna, executive vice president of the National Machine Tool Builders Assn., was honored at a dinner attended by the board of directors and past presidents of the association. Berna, who is retiring on February 1, 1957, entered the machine tool industry with Cutler-Hammer Co., later becoming associated with G. A. Gray Co., Union Twist Drill Co., and National Acme Co. He became general manager of the National Machine Tool Builders Assn. in 1937.

New president of the Gray Iron Founders' Society is **J. Scott Parrish, Jr.**, Richmond Foundry and Mfg. Co., Inc. **A. M. Nutter,** E. L. LeBaron Foundry Co., was elected vice president and Messrs. **A. H. Renfrow,** Renfrow Foundry, and **H. J. Trenkamp,** The Ohio Foundry Co., were elected secretary and treasurer respectively. **Cecil R. Garland,** The W. O. Larson Foundry Co., is assistant treasurer.

Two executive appointments have been announced by Chrysler Corp. **Frank H. Brown** is manager of production planning and material control for the stamping division and **Harry R. Bentley** is manager of the corporation's Trenton plant.

Firth Sterling, Inc. has announced the appointment of **Robert Logie** as executive vice president. He has also been elected to the board of directors. Before joining Firth Sterling, Logie was connected with The National Roll & Foundry Co., most recently as president. **Errett Grable,** president of Wear-Ever International, Inc., has also been elected to the Firth Sterling board.

Two automotive industry pioneers, **Irving T. O'Brien** and **Otto W. Franke,** both of Chrysler Corp., have retired. O'Brien, whose association with the late Walter P. Chrysler began in 1919, was group executive responsible for the over-all supervision of Chrysler's Airtemp, Amplex, Cycleweld Cement Products, and Marine and Industrial Engine divisions. Franke was director of production engineering at the time of his retirement.

The election of **Joseph L. Kane,** Rear Admiral U.S.N., retired, as a vice president has been announced by Kennametal, Inc. Adm. Kane will help plan the company's expansion program and will serve as coordinator of the firm's activities with government defense agencies.

William G. Dvorak, former assistant chief engineer of Torrington Co. has joined Bruce Payne & Associates, Inc., management consultants. As a senior associate, Mr. Dvorak will function primarily in the areas of methods, plant layout and industrial engineering.

Thomas W. Johnson has been elected vice president of the New York Air Brake Co. In addition to his present duties as group executive in charge of the Vacuum Equipment and Kinney Manufacturing divisions, Mr. Johnson will assume additional operating duties.

Richard T. Thornton has been appointed manufacturing manager of Ford Motor Company's General Products Div. Mr. Thornton will direct production operations of the division's glass and general manufacturing plants as well as plant and manufacturing engineering.

C. J. Wilson has joined Bullard Co. as director of manufacturing. An electrical engineer, he was formerly associated with Westinghouse and most recently was works manager of Mergenthaler Linotype Corp. Mr. Wilson is a graduate of the University of Colorado.

Firth-Loach Metals, Inc., has appointed **Robert C. Lindberg** as production manager. He started his career in the carbide division of Firth-Sterling Steel Co. in 1935. Before joining Firth-Loach in 1954, he was in charge of development for Firth-Sterling's carbide production department.

Several appointments recently were announced by Progressive Welder Sales Co. **L. F. Van Nortwick,** formerly truck sales manager of Chrysler Corp. Dodge Div., is new general sales manager of Frostrode Div. of Progressive Welder's Warren Alloy Div. **Bernie Walker,** who has been master mechanic and manufacturing engineer, was named assistant director of manufacturing. **George W. Enk** is new general sales manager for Progressive Welder Sales Co.'s United States and Canadian operations. **E. J. Formhals** is general manager of the Canadian plant in Chatham, Ontario.

New general manager of Gardner Machine Co., a subsidiary of Landis Tool Co., is **Vernon L. Loofboro.** He succeeds **R. E. Price** who has been transferred to Landis Tool Co. as vice president and assistant general manager. **John Mourer** has been appointed assistant general manager of Gardner Machine Co.

Enoch While, chief inspector at Allis-Chalmers Norwood (Ohio) Works since 1947, has been named works manager there succeeding **J. F. Costigan,** recently appointed assistant director of manufacturing, Industries Group.

Sam Gurley Jr. was elected vice-president-sales for H. K. Porter Co., Inc. Until recently, Mr. Gurley held a similar position with Reichold Chemicals, Inc.

Fred S. Van Valkenburg has been elected chairman of the board and **A. Dale Mitchell** made president of the Waterbury Farrel Foundry & Machine Co.

Promotion of **K. H. Zinsmaster** from director of purchases to manager of procurement and production planning has been announced by Aro Equipment Corp. He will head a new department with full responsibility for materials procurement, inventory control, production control and production planning for long and short-term periods.

Charles E. Bagwell has been named chief engineer at Hanson-Van Winkle-Munning Co. He will be in charge of all equipment design and engineering for the company's line of automatic metal-finishing machines and processes.

good READING

International Dictionary of Physics and Electronics—*by Dr. Walter C. Michels, Senior Editor. Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Price $20. 1025 pages.*

This definitive book brings together the physics terms important to scientists and technologists and also important to engineers in laboratories, research and in the plant. Terms defined include laws, relationships, equations, basic principles and concepts, as well as the most widely used instruments and apparatus.

The units and system of units, so important in physics, are treated both by definition and a comprehensive discussion at the beginning of the book. For those without an extensive mathematical background, both simple and thorough definitions are given in most cases.

To facilitate the use of this book for reference purposes, a comprehensive plan of cross referencing has been devised. In all, the book is of decided value to engineers and shop personnel for whom a familiarity with physics terms is increasingly essential.

Applied Automation—*Edited by James Custer. Published by Chilton Publications, Chestnut and 56th Sts., Philadelphia 39, Pa. Price $6. 235 pages.*

Applied Automation describes the continuing technological progress which has accelerated interest in the approach of the continuous automatic production line. It comprises a group of significant articles that appeared in the magazine *Automotive Industries*, showing the application of modern automotive techniques.

The book is profusely illustrated and includes operational data on machining, plating, welding, forging, and other operations in use in the automotive industry.

A SCIENTIFIC SAMPLER—*by Raymond Stevens, Howard F. Hamacher and Alan A. Smith. Published by D. Von Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Price $6. 434 pages.*

Here are short and readable essays on science, as it affects man, and the methods of science, to be enjoyed by both laymen and specialists alike. Originally published in the Industrial Bulletin of Arthur D. Little, Inc., these articles appeared in the Bulletin over the past thirty years and have brought authoritative information on the present status and possible future trends of industrial development. They are brief, informative and free of technical jargon.

Brought up to date by authors' notes and comments, this collection of stories makes interesting reading for everyone interested in the how and why of scientific progress.

CAMS-DESIGN, DYNAMICS, AND ACCURACY—*by Harold A. Rothbart. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $9.50. 364 pages.*

This book is written primarily for the designer concerned with creating a mathematical function, motion, mechanism, machine or mechanical computer.

The author provides a lucid coverage of both the theoretical and practical aspects of the subject. On the practical side, he makes concrete recommendations concerning such topics as mass, acceleration, materials and the type of cam follower to be used. Of special interest is the discussion of profile accuracy and errors. Mathematics is kept to a minimum throughout the book.

AN ENCYCLOPEDIA OF THE IRON AND STEEL INDUSTRY—*by A. K. Osborne. Published by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. Printed in Great Britain. Price $25. 576 pages.*

The purpose of this book is to provide a concise description of the materials, plant, tools and processes used in the iron and steel industry, and in those industries closely allied to it. Starting with the preparation of the ore, the book follows the processes right through to the finished product, defining the technical terms employed.

The book is intended as a reference and not in any sense as a textbook. Specialists might use the book for subjects bordering on their own, but primarily the book is intended for smaller plants and shops which have not yet attained sufficient size to warrant maintaining a library of their own.

This work represents a recently revised presentation of material collected over more than a quarter of a century from American and European sources.

technical Shorts

Coating for Corrosion Resistance

DESPITE MANY YEARS of intense research, corrosion of metals is still a major problem of industry. Hence, there is always a great deal of interest when new processes are developed which give greater resistance to attack by water and chemicals.

In a test by Grand Rapids Testing and Research Laboratories, a treated panel of aluminum alloy base material withstood more than 2000 hours of exposure to a salt spray with no evidence of base metal attack or related manifestations of failure.

The panel was previously treated with a single coating of "Selinizing Fluid," a silicone resin dispersion in compatible organic solvent produced by the Selinized Process Co. The fluid was sprayed on, allowed to air dry, then baked for one hour before being placed in the salt box. Thickness of the coating is 0.2 mm.

V V V

Ceramic Exhaust Nozzle

A SIX-INCH DIAMETER ceramic exhaust nozzle for ramjets and afterburners is reported to have much longer life than metal nozzles and to be capable of operation at much higher temperatures. The basic ceramic formula was developed by Alfred University and applied to fabrication of nozzles by Electro Refractories & Abrasives Corp.

Since one of the major blocks in development of air-breathing power plants is durability of the materials employed, the ceramic nozzle may make it possible for jet planes and missiles to go to higher speeds because of the higher operating temperatures which can be achieved without nozzle failure.

The ceramic material may also find use in flame holder applications as well as in exhaust nozzles.

V V V

Nonmetallic Ceramic Material Patented

TWO PATENTS were recently issued on a new ceramic material that is nonmetallic, electrically nonconductive, yet which can be permanently magnetized to hold strength under adverse conditions. The patents, Nos. 2,762,777 and 2,762,778, are controlled by North American Philips Co., Inc., which refers to the material as Ferroxdure. A number of American companies already are licensed to manufacture it.

According to Dr John A. Hipple, Director of Research for Philips, the present and future applications for the material include its use in refrigerator and cabinet door latches, in loudspeakers and in television for focusing yokes. It will also be useful for motors and generators, oil filters, rotating mechanical couplings, cushioning devices and toys.

No critical materials are needed to produce the magnetic ceramic. Ferroxdure is unaffected by external fields and cannot easily be demagnetized once it has been polarized. It can be readily molded into various shapes. Compared with metal magnets, Ferroxdure is smaller in size and lighter in weight. It has a long effective life, and provides good performance and cost savings.

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

International Machine Tool Show

A report on the international machine tool show held in London, England, is presented by F. Koenigsberger in the October issue of *Werkstattstechnik und Maschinenbau.* Among the numerous machines mentioned, a special bucket wheel turning machine by G. Fischer may be of interest to tool engineers. A front tool and a rear tool are used; they oscillate about a vertical axis through an arc of 120 deg instead of being traversed along the workpiece as on standard lathes.

Vertical boring mills, one by G. Richards of England, and the other by Berthiez of France are equipped with profiling attachments, one hydraulically operated, the other one mechanical for operation in two planes simultaneously.

The Société Genevoise, SIP of Switzerland, showed a highly accurate machine for measuring threads. A horizontal boring mill with electronic controls was shown by Kearns (Eng.).

Grinding

Several articles were published recently on grinding and grinding wheel research. Among them is a paper by C. Berstecher in *Industrieblatt,* No. 7, 1956, on the properties of self-cooling grinding wheels. The author indicates that immersing the wheel in synthetic liquid resin impregnates the wheel and acts as a permanent lubricant. In addition, the grains are supported better. It is also claimed that rapid wear at the edges can be reduced by the application of resin solution, and that the hardness of the wheels is increased, permitting greater feed and shorter grinding time.

Another paper, published by A. Hornung in *Fertigungstechnik,* 1956, Vol. 2, Nos. 2 and 3, deals with the relationship between specific cutting resistance, the thickness of the chip and other grinding variables. The author indicates that published data on grinding forces are not in agreement and sug-

gests that this disagreement is due to disregard of the wear of the wheel in computations.

Grinding carbide tools is discussed by J. Peklenik in *Industrie-Anzeiger*, Vol. 78, 1956, No. 63. He ran tests with cup wheels and used the tool life of the carbide tool as a criterion for the quality of the grinding. The author found that the product of effective contact area between wheel and tip, grinding speed and the number of passes is a constant for a given type of carbide.

In the same issue K. E. Schwartz describes tests on the wear of grinding wheels and illustrates the differences between actual grain wear and breaking out of the grains. Also in this issue, H. Schuler mentioned reports on the effect of the grinding machines on the surface finish, which he measured by contact and by instrument. His paper also covers a comparison of fine turning and grinding and includes curves showing the relationship for various dimensions and surface finish.

Machining Plastics

Although plastics are usually produced by molding, it is often necessary to machine them when close tolerances are required. H. Zickel, in a book published by Carl Hanser Verlag, describes the methods and tools used in the machining operations, particularly with carbides, which can endure the highly abrasive effect of the plastic materials.

Programming Jig Borers

Preselectors and programming devices for jig borers have been used only when accuracy requirements for positioning were relatively low. Their range of positioning accuracy was considered to be between plus or minus 0.0004 and plus or minus 0.002 inch.

Recently, however, as pointed out by K. Haeuser in the October issue of *Werkstatt und Betrieb*, considerably greater precision is being obtained by jig borers equipped with combined pneumatic-electrical control mechanisms. Positioning accuracy is as high as plus or minus 0.000080 inch. The author describes this machine in detail. It incorporates an optical measuring device and a special feed motor with an electric brake. This brake makes it possible to instantly reduce the feed when the correct position is approached.

Thread Cutting with Carbide Tools

Carbide tools are infrequently employed in cutting threads because of the difficulty of withdrawing the tool rapidly at the end of the cut. Problems involved are discussed by C. H. Stau

in *Werkstatt und Betrieb*, No. 10, 1956.

The author suggests the use of hydraulically operated copying devices and describes a method requiring two templates, one for the threading operation and rapid withdrawal, and one for the return of the tool to the start position. The latter template is designed so that it prevents the tool from entering the precut thread on the return.

Since the speed with which the tool is withdrawn is of great importance for maintaining accuracy of the thread and for good tool life, it is necessary to determine the relationship between cutting speed and speed of withdrawal of the tool. The author presents formulas developed for this purpose.

Metal Cutting Research

Serrations appearing on the rear side of chips, which are a familiar sight to all machine shop men, have become a topic of a scientific metal-cutting project at the University of Vienna, Austria. E. Eder, the researcher, reports on his findings in *Werkstattstechnik und Maschinenbau*, No. 10, Vol. 46, 1956. He indicates that the formation of serrations can be investigated by two methods; the first assumes that the system of "tool-work-machine" is rigid, eliminating vibration attributable to it; the second assumes that the system is flexible, introducing vibration. He approaches the theoretical part of the project by assuming rigidity but plans at a later date to investigate changes due to flexibility.

Plunge cuts were taken on a dual drive lathe on two types of workpieces. These were a chrome-nickel steel of 300 Brinell and a steel billet of 250 Brinell. The cuts removed circumferential ribs of 0.1-inch width which had previously been cut into the workpieces. Rake angles of the tools were varied from —20 to +10 deg and feeds from 0.0016 to 0.0075 inch.

High cutting speeds between 600 and 1300 fpm were used to eliminate self-induced vibration and increase tool life. The chip compression was measured and also the shear angles, using formulas developed by Ernst and Merchant.

The tests disclosed that the distance between serrations increases nearly proportional to the feed. On the other hand, the width of the serrations decreases rapidly with increasing cutting speed, while the rake angle has no apparent effect on the formation of serrations. The rate at which the serrations are formed, from 10,000 to 50,000 per second, is high and may give some clues to the solution of metal-cutting problems. The author also offers a new analysis of the stresses in the workpiece material at the cutting edge in plastic flow.

who's meeting and where

Jan. 14-18. Society of Automotive Engineers, Inc. Annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich. Other details may be obtained from society office, 29 W. 39th St., New York 18, N. Y.

Jan. 16-18. Society of Plastics Engineers. Thirteenth annual technical conference. Sheraton-Jefferson Hotel, St. Louis, Mo. For information, contact society office, 34 East Putnam Ave., Greenwich, Conn.

Jan. 28-31. Plant Maintenance & Engineering Show, Public Auditorum, Cleveland, Ohio. For more information, contact the exposition management, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Jan. 30-31. American Society for Engineering Education. Annual college-industry conference sponsored by ASEE Relations-with Industry Div., under auspices of UCLA College of Engineering and University Extension, at University of California Los Angeles. Direct inquiries to University of California Extension, Engineering, Los Angeles 24, Calif.

Jan. 30-31. Illinois Institute of Technology. Midwest welding conference sponsored jointly by Armour Research and Chicago chapter of American Welding Society, Illinois Tech Chemistry Bldg., 3255 S. Dearborn St., Chicago, Ill. Write for details to Harry Schwartzbert, Supervisor of Welding Research, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Feb. 19. American Society for Quality Control, Rochester Section. 13th annual quality control clinic, War Memorial, Rochester, N. Y. Details may be obtained from Thomas J. Soebbing, Navy Ordnance Div., Eastman Kodak Co., 50 Main St. West., Rochester, N. Y.

Feb. 5-7. The Society of the Plastics Industry, Inc. Reinforced Plastics Div. conference, Edgewater Beach Hotel, Chicago, Ill. Contact society office, 250 Park Ave., New York 17, N. Y.

Write for a copy of the OTTAWA 60 BLUE SHEET

This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.

ADDRESS DEPT. TE-85

OTTAWA 60 is a *new* die steel, an A-L "original," developed primarily to deep draw and form stainless steel. As intended, it performs without galling or pickup and shows exceptional wear resistance in that service. We have plenty of case histories to show you in proof.

But *wherever* you use Ottawa 60 draw dies—not just on stainless steel—this high-carbon, high-vanadium alloy comes through for you. Illustrated above are the first and second draws on transformer housings, produced from .037" gauge SAE 1010 strip. The company formerly used dies made of 5% chrome air-hardening die steel—and later a more highly alloyed material—without ever getting more than about 2000 pieces before the dies began to show gall marks and pickup, and parts were rejected due to scoring, breakage and oversize. *Dies made from Ottawa 60 forgings cured that! Results after 25,000 pieces showed no pickup and no wear on punch or die.*

● You can solve many a problem and save real money with Ottawa 60 draw dies! Write for information or call in our Field Service Staff to help you get started. ***Allegheny Ludlum Steel Corporation, Oliver Bulding, Pittsburgh 22, Pa.***

For nearest representative, consult Yellow Section of your telephone book

For complete **MODERN** Tooling, call
Allegheny Ludlum

A-L FINE TOOL STEELS SINCE 1854 ®

WBW 5463 A

the role of Manufacturing Management in mass production

Tech Digests

By H. A. C. Anderson

**Pontiac Motor Div.
General Motors Corp.
Pontiac, Mich.**

Mass production such as exemplified in the automotive industry depends for its success on a number of engineers who play important roles behind the scene of operations. Manufacturing at Pontiac finds a functional organization head by a general manufacturing manager. Reporting to him are three men. First, the manufacturing manager under whom are grouped all producing plants and manufacturing engineering operations. Second, a production manager whose organization handles scheduling and movement of parts and materials as well as completed automobiles. Third, a chief inspector whose quality control organization is responsible for checking, testing and maintaining quality standards.

The main production plants include: heat-treating and manufacturing lab, plating, axle machining and assembly, foundry, sheet metal, engine and car assembly. These plants are staffed with engineers in key production and quality control positions. These men, with the possible exception of those connected with the laboratory, must have a good knowledge of people as well as machines.

Manufacturing operations are controlled by two important documents. The first answers the question, how many are to be built and when. This is the production schedule approved by the general manager. It is often called the Bible. The second document answers the question, what is to be built. It is product engineering's manufacturing release and covers approved and tested designs spelling out for each part applicable drawings and specifications. Each release is approved by the product engineer responsible for that part.

Servicing the various plants are manufacturing engineering departments whose heads, also reporting to the manufacturing manager, direct background technical operations—which are the foundation of quality, cost and efficiency of production. Results of their ideas, installations of machine tools, automation, *Figs.* 1 and 2, and handling conveyors, are apparent throughout the plant.

These engineering departments are specialized. Plant engineering is responsible for maintenance of all properties, buildings and equipment. The plant engineer who directs the department also contributes to design and fabrication of all new equipment ordered to increase or facilitate mass production. His staff of mechanical, electrical and civil engineers is supported by a large group of skilled technicians such as millwrights, carpenters, electricians, electronic specialists, plumbers and power house attendants. The group's responsibilities also comprise supplying of all necessary utilities to service production, such as air, water, gas and electricity.

The master mechanic department has responsibility for selection and specification of machine tools and tooling as well as their maintenance. The department is comprised of process engineers, tool engineers and machine designers, as well as tool analysts, tool inspectors, repair men and other technicians.

Planning and standards, under the superintendent of planning and standards are grouped in a number of technical staffs. These are plant layout, work standards, methods engineering, cost estimating, hourly rate employee classification, property records, manufacturing research, future project planning and development laboratory in which mechanical and electrical engineers specialize in automatic devices.

In addition to these departments, there are other staff operations vital to manufacturing such as the employee suggestion program and materials utilization committee. Both of these result in valuable improvements. For instance, the materials committee considers opportunities to engineer improvements in use of material salvaged from other operations, substitution of material of lower cost while maintain-

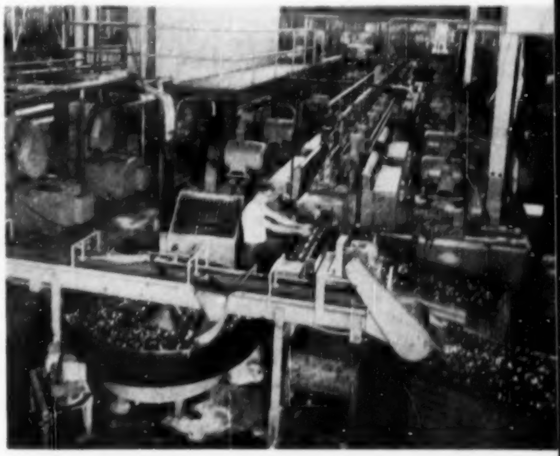


Fig. 1. Over-all view of the piston rod automation line, showing over-all flow of parts and general arrangement of machines. Demand type conveyor (foreground) feeds the line at the required rate.

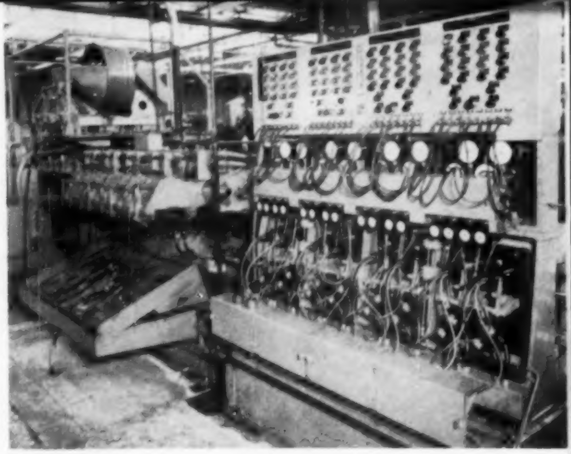


Fig. 2 One of the gaging setups for checking critical dimensions and segregating rods selectively.

ing quality, modification of processes to reduce quality of material and modification of design for the same end.

Meetings of supervision and training programs are also an essential part of manufacturing management. Improved safety, personnel relations, tool selection and utilization are some of the subjects covered.

Management Reports

Two types of reports keep manufacturing management informed of its competitive position. One of these is the general service manager's report, indicating customer reaction and satisfaction with the product. Close personal contact is maintained between engineers of quality control and service departments.

Direct labor costs are evaluated in a daily efficiency report which compares actual costs against standards for each plant and major departments. Other costs are reported for control purposes on a daily plant report. These cover indirect labor, operating supplies, tools, power, maintenance, employment benefits, taxes, etc. They are shown as actual dollars vs. budget and serve as a road map to manufacturing management.

The coordinated work of this team is to install continuous improvements in production. A typical example is the connecting rod automation installation, *Fig.* 1.

After product engineering furnished manufacturing releases, process engineers under the master mechanic specified the operations required. At this point, the decision was made to pioneer in new automation setup. As a result, basic process planning had to be closely coordinated with the machine tool builders' engineering. The equipment was developed in three sections. The first performs 12 different boring, reaming, chamfering, checking operations; the second performs 9 different drilling, milling and checking operations, and the third performs 12 different reaming, chamfering, bushing assembly, gaging and drilling operations. All three sections have multispindle heads. Each work station performs the same machining on groups of 8 rods simultaneously. In each of the three sections these groups move automatically from station to station, *Fig.* 3.

Fig. 3. Control panel at one of the major machining stations of line.

Automation Development

After tryout at builder's plant, machines were dismantled and shipped to Pontiac where they were moved in and wired by plant engineering and assembled by the master mechanics department. Machines and foundations were located according to a plant layout prepared by engineers of standards and planning departments.

In this setup, each rod is checked 100 percent on all critical dimensions in automatic gages, *Fig.* 2, which reject those not within specifications. Each rod is milled and held to rigid specifications of weight and center of gravity. In addition, all rods are segregated as to pinhole size and marked for selective fit at assembly in increments of one ten-thousandth inch in diameter.

Installation of this equipment was not without problems. Even after machines had been debugged and improvements made in fixtures, tools, coolant and electrical systems, costs were substantially above estimates.

How these were worked out illustrates cooperation of the various parts of manufacturing management. For instance, a toolmaker through the employee suggestion program improved the nesting fixture of the number two section by adding a gage rail. This made possible eliminating hand gaging and prevented oversize rods from get-

ting into machines and causing costly jams.

Other improvements were developed by the planning and standards department by making detailed down-time checks, work-standard evaluations and other studies which resulted in desired improvements.

From a talk given before the Society of Women Engineers 1956 Convention, Detroit, Mich.

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Standards—Free or Dictated

By H. Thomas Hallowell, Jr.
President
Standard Pressed Steel Co.
Jenkintown, Pa.

Economic and technological infiltration by Russia throughout many parts of the free world represents the greatest threat to this nation's security and freedom. Even though not now engaged in a shooting war, this country is involved in the fiercest technological competition that has ever been waged between two nations.

What must be of concern today is the possibility that a stop in shooting wars may cause a lull in development of national standards, simply because the need for them seems less urgent. Yet the development of standards in times of peace is scarcely less important than in war.

Russia is engaged in all out efforts on vital crash programs of education, engineering and production with comparatively little regard for the well-being of its populace. Russia can dictate

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national standards. This may seem like a tremendous advantage because standards are the key to reducing waste, eliminating duplication, increasing efficiency and raising productivity.

A particularly impressive example of Russian standardization resulted in one machine tool plant producing some 15,000 standardized semiautomatic lathes a year. This contrasts with all American machine tool builders whose combined production is 1000 such lathes in a year, many of which are different in design and standards.

Russian achievements in education, production and standardization must be taken as a serious challenge. On the other hand, one should not be everimpressed by them, either.

Their methods contain a strong element of eventual self-defeat. They can become too rigid, overshoot their mark and lose completely their usefulness in relation to other elements of the economy. An error at the heart of such a highly centralized state can convulse the entire economy.

Strength of democratic institution lies in the delicate interplay and balance of spontaneous creative forces and on voluntary contributions of its members. History has supplied ample proof that free societies are generally more creative, more productive and in the long run more efficient than slave states and tyrannies.

A free society also has its germs of self-defeat, however. They are trends to dissipation of efforts, self-individualism and entrenchment of interests. Constant vigilance and regeneration are needed to keep society sufficiently elastic and strong for constant progress.

Several tremendously important developments in standards have occurred in the past few years. Whole industries, for instance, are participating in standards work for the first time. A new industrial technology, atomic power for peaceful use, is striving to develop national standards as it grows and expands, instead of later when the industry will have become solidified and standards will be impossible or extremely difficult to write.

The facts of standardization are bet-

ter and more widely known than ever before. More people understand that standards bring added safety in daily living and working; they improve efficiency and reduce wear and tear on the human spirit. They are the means for competition on the basis of quality and performance.

Finally, there is an amazing and constructive change in the attitude of government toward the standards movement. In some ways, government people are ahead of industry in recognizing the need and value of a comprehensive set of true national standards.

From an address given before the American Standards Assn., 7th National Conference on Standards, Oct. 1956, New York, N. Y. American Standards Assn., 70 E. 45th St., New York, N. Y.

▼ ▼ ▼

Sizing Up Automation

By H. B. Osborn, Jr.

Technical Director
Tocco Div.
Ohio Crankshaft Co.
Cleveland, O.

Man historically has created the tools necessary to his existence. Basic tools of early processing methods were the lathe and milling machine. The relatively new principle of interchangeability, which is the backbone of mass production, is requiring greater precision. For this, machine tools cannot rely on human proficiency and so must be automated; that is, to control and regulate themselves.

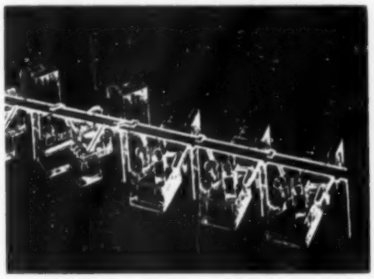
This aspect of control and regulation has been more readily applied to many processing methods outside of metalworking. It has been somewhat difficult to build into automatic metalworking machines the judgment of a skilled operator. By contrast, consider the automatic features of electrical, mechanical and hydraulic controls which operate the chemical industry, as well as household gimmicks in refrigerators, heating plants, etc.

Such controls in countless numbers are finding their way onto and into metalworking machinery to make decisions and adjustments beyond the ability of a human being. One reason why industries which process liquids and gases have automated so quickly is because a man does a pretty miserable job of handling these with his hands.

Contrary to popular conception, automation has not been so widely adopted to increase production in a rapidly

rising labor-cost era, but rather as a necessity of modern times which finds fewer skilled hands to satisfy tremendous demands for products of uniformly high quality.

Today, the word feedback has a new meaning. This is the control and regulating system built into an automated process, substituting for eyes, ears and feel of men it has replaced. A machine line which puts together a series of



Addition of a conveyor system, automatic regulation and control to standard machines makes one type of automation.

operations and then controls and regulates, seems to be the popular conception of automation. But many plants today are upgrading their processing by simple addition of loading and unloading devices and automatic controls. This too is automation.

Recent studies show clearly that advent of more complete automation is bringing a revision in concept as to optimum economic plant size. It is not the great big plants for complex assemblies that will be most highly automated. The all-under-one-roof concept is definitely opposed to what is best for automation. Some concerns are going to need new plants, smaller ones. The best field for automation apparently is a medium-sized plant, one making a few simple things such as pots and pans, toys, pipe and pipe fitting, etc.

Assembly Line Automation?

There will be more and more automation in the automotive industry—they can get away with it. It is going into the manufacture of parts the public cannot see — processing of engines, manufacture of transmissions, production of axles and other subassemblies and components. Why? Because these assemblies can be expected to stay put reasonably well for a period of time.

What about the assembly line? This admittedly is one of the most difficult in the field of automation. This is being approached when subassemblies such as automotive engine parts are put together, but this is far from tacking on

the top of a convertible.

How about the electronic computer? This gadget is widely proclaimed as a substitute for the human brain. While the computer has speed which permits it to do in seconds what the brain may take hours to do, for the most part computers are single channeled and to that end no match for a human being who is multi-channeled. For example, a human can see, smell and feel a fire; the brain takes all of these into consideration at once, and decides what to do about it. This would require a very complicated three-channel computer to do the same thing. The extent to which this mechanism can be applied to automation is largely a matter of economics.

Emphasis on automation will produce major influences on design of future products. It may stimulate a tendency toward standardization of components, even though there may be less standardization of assemblies.

Since the primary purpose of automation is to improve quality and production, anything in the product design or automation layout which adds nothing to these factors is excess baggage.

From a paper given at 1956 International Harvester Company Automation Conference, Chicago, Ill.

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What Management Should Know about Quality Control

By F. L. Riggin, Jr.
Executive Vice President
Mueller Brass Co.
Port Huron, Mich.

Statistical quality control has been a part of the company program for three years. The first year was devoted to preparing personnel to accept and work with an entirely new idea of production control; the last two years, to the gradual installation of the program. It is anticipated two more years will pass before complete coverage is accomplished.

Four things are expected of quality control: reduced scrap, less rework, lower inspection costs, and improved quality resulting in fewer customer complaints. These objectives cannot be attained overnight or without hard work. The results more than justify the costs and the problems, but, unless there is a good understanding of what is involved, considerable disappointment and concern will plague officials of any company.

In one department, in one year, scrap was reduced from 3 percent to less than 1 percent, a savings of 1½ million pieces. Repair losses were reduced from 1¾ percent to 1 percent, a savings of 200,000 production parts. Inspection man hours were reduced from 16 for 10,000 pieces produced to 8 man hours per 10,000 pieces. This savings is approximately $100,000. Customer complaints have been halved and also reduced in severity.

How to Install S.Q.C.

Statistical quality control is no gimmick; it is a philosophy of production control which must be learned and accepted by management and the entire production force.

Only after management has had a complete survey of all the facts should it attempt a decision on adopting statistical quality control. The program must have absolute management backing and the quality control department must have proper prestige and authority to be successful. People resent change because they feel it represents a threat to the security of their job. Preliminary training and preparation of supervisors and union committees are necessary to secure their backing.

Production employees are required to read and understand blueprints and micrometers. This too may require training. The program may require replacement of some equipment which is incapable of holding property quality limits. It probably will require a stepped-up maintenance program to keep machines in better condition. Additional gaging may be needed.

Statistical quality control, properly installed, will eliminate many inspection jobs. It will also require production workers to accept more responsibility for their work. Strong union opposition may be encountered on both points. The union negotiated an increase in incentive pay as a result of the increased responsibility put on production workers. Management should recognize that they may face a similar problem.

Orientation or explanation are needed for union leaders. If they understand the program and over-all benefits for company and employees, many serious problems can be eliminated or at least solved.

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The program also requires changes in functions and attitudes of supervisors. Management should recognize that some supervisors may not be able to grow with new production ideas. They must be prepared to face such problems and deal with them promptly and fairly so that success of the program is not jeopardized. Despite the problems involved, however, the results cited are well worth the effort.

From a paper given at the Michigan forum of the American Society for Quality Control, University of Michigan, Ann Arbor, Mich., Sept., 1956.

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Contour Machining, Future Problems

By R. W. Peters
Chief of Tooling
Consolidated Vultee Aircraft
Div. of General Dynamics
San Diego, Calif.

In the future, production requirements for contouring metals in the 280,000 psi range and capable of withstanding 1500 deg temperature may be expected. In machining high heat-treat steels, development programs have discovered that cutter life and rigidity with higher horsepower of machines are main determining factors for removal of metal in this range. Another main problem for high Mock aircraft is the fastening technique, so engineers are looking for larger forgings and skins in order to eliminate splicing.

At Convair some anticipated skins would be stainless steel, $\frac{3}{8}$ of an in. thick, 6 ft wide and 40 to 50 ft long. The first question is where the tonnage requirements are available to form such a skin in compound contours, but this problem is minor compared to the contour sculpturing of this skin after forming.

A comparison of machining a titanium spar rail vs. aluminum can be made at this time from known data. To remove $\frac{1}{2}$ an in. of metal within the same schedule from a titanium spar rail 40 ft long would require 15 spar mills where one would suffice in aluminum. This calculation is based on cutters which would have a life of approximately 15 times that of present cutters. The possibility of using diamond cutter tips is being explored in this connection.

Aircraft factories have the same problem of other manufacturers, that of space and production schedules. Close

coordination must be maintained between the airframe, cutter and machine tool manufacturer to reduce space requirement for machine tools and meet production schedules for aircraft in the future.

Fig. 1. Setup for stack profiling utilizing a tracer controlled adaptation.

Another requirement to anticipate is that of tape controlled machine tools. A large training program will be needed before such equipment can be used in production of contour parts. One setup located in the Sheet Metal Dept. of Convair has saved considerable time in handling of parts by eliminating sending them to the machine shop for profiling. This machine, *Fig.* 1, can profile not only aluminum but also chrommoly and stainless steel sheet, stacked 1 in. thick. The tracing template is a standard mark template and the machine cuts its own backup block, utilizing the template to assure proper backup while production parts are cut. Feed of the machine is 0 to 24 in. per min.

Convair has adapted mills to tracer control both in experimental and machine cuts its own backup block, utiliz- milling, the part shown in *Fig.* 2, setup

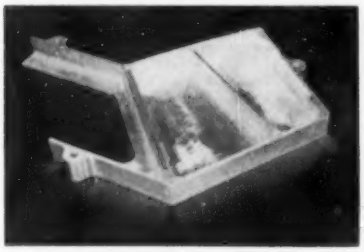

Fig. 2. Aircraft contour milled part formerly produced on conventional vertical mill.

time was reduced from 10 hr on a conventional vertical mill to 2 hr utilizing tracer control. Machining time was reduced from 7 hr to 1 hr and 25 min. on the tracer machine. This is typical of advantages that can be secured by utilizing the potentialities of contour tracing.

From a paper given at the 1957 True-Trace Conference, Los Angeles, Calif.

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Mutual Management in Big Business

By Elisha Gray, II

**President
Whirlpool-Seeger Corp.
Evansville, Ind.**

Big business, sensitive to the needs of the individuals who comprise it and to the requirements of society, will be the surviving form of enterprise in mass-production and mass-marketing industries. Of prime importance is the place of the qualified individual in the mutual management of a big corporation. A model business will be oriented strongly toward the individual. All management decisions will be made with a full understanding of the place of the individual. He needs an opportunity to make complete use of talents constructively; opportunity to learn and grow in abilities, skills and judgments.

Big business does not want men with talent to be lost—it needs their best efforts desperately. The model company will setup a thorough method for appraising abilities of all of its men to guide their training to best roundout their skills and prepare them for opportunities that open up in their firm.

The operation of a large business today is so complex that it is impossible for any one individual to be qualified in all facets of the operation. Therefore, management decisions ideally flow from the bottom up. In a successful big

business everyone who is qualified must manage, not just the top few. This might really be called mutual management. The role of top management is to weave into an effective whole a group of specially talented people, each of whom is an expert in his own field, rather than to carry out personally all management functions.

The form or size of business that will prevail in each field will be the one that proves it can best serve the public. It is unlikely that this country will pass laws legislating against a business form that could provide a better service or product to the mass of consumers, even though to do so, it might grow very large.

In fields where large accumulations of capital or facilities are needed to keep up with technological growth and where national selling is done through expensive mass media, basic business arithmetic is forcing enterprises to expand. The automotive industry is the classic example of an industry where big business is the most successful form of enterprise. For example, it would be impossible for the small operator to afford the engineering staff required to design a modern automobile and to keep up with technological improvements that are multiplying so rapidly.

Ideal for the successful big business is the attitude where each individual puts his best talents to work. He is guided, of course, by a clearly defined company goal and a governing management that has the courage and aggressiveness to steer a bold course with the wisdom to know that only by true participation that all levels can the trip be successfully completed.

From a speech given before the Evansville Foreman's Club, Evansville, Ind., October, 1956.

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Joining Aluminum to Other Metals

By K. V. Lutz
All-State Welding Alloys Co., Inc.

Numerous advanced materials for the welding shop now make it feasible to join aluminum with steel, stainless steel, monel, nickel, copper, brass, etc. These materials can be designed for fabrication together without serious limitations in joining of the dissimilar metals.

An extensive program of developing alloys and fluxes for such purposes has been under way since the copper shortage. This has been accelerated by increasing use of aluminum with other

metals.

For joining aluminum to copper, for instance, materials and methods had to be developed for manual field application. Electrolytic corrosion susceptibilities were of paramount importance as in the substitution of aluminum fittings for copper in air conditioning, plumbing and heating installations and of electric conduit cable for copper in power transmission.

In addition, materials and methods were required for automatic machine applications where they had to meld smoothly into special production procedures such as in joining filament wires to lamp bases. The solutions of many such problems are described.

From a paper given at the 1956 National Fall Meeting of the American Welding Society, 33 West 39th St., N. Y. 18, N. Y.

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Where To Use Silicone Lubricants

B. W. H. Ragborg
and
W. H. Badger

Product Development Lab.
Dow Corning Corp.
Midland, Mich.

Silicone fluid and grease lubricants have found a wide variety of special applications in industry. They are of value where oxidation resistance, thermal stability, moisture resistance, low volatility, and excellent consistency or viscosity temperature relationships are essential requirements.

Because high equipment operating temperatures are quite common in the steel industry, silicones have already solved some difficult lubrication problems. The unique properties of these materials should make them interesting in still other high temperature lubricant problems.

Development work presently under way indicates that silicone fluids with much improved load-carrying capacity for ferrous metals in sliding contact can be made. Increases in high temperature stability may also be possible. Such improvements should extend the usefulness of silicone lubricants.

From a paper presented at the 1956 American Institute of Steel Engineers Convention. Address 521 Oliver Bldg., Pittsburgh 22, Pa.

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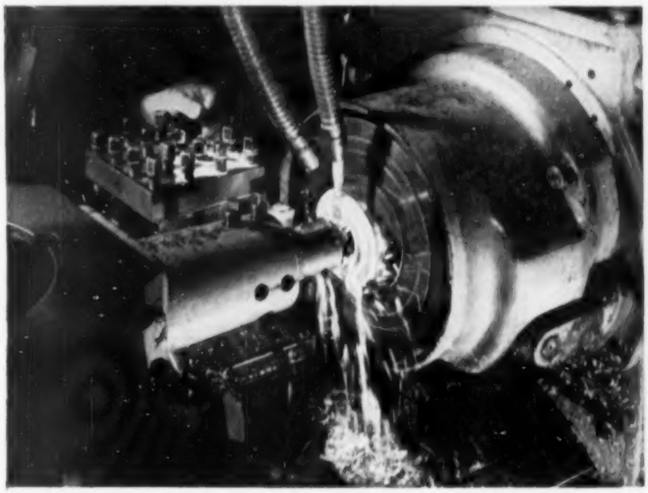

Stopping Corrosion

By R. P. Mills
Manager
Rust Preventive Div.
Valvoline Oil Co.
Div. Ashland Oil & Refining Co.
Freedom, Pa.

Corrosion is an ever-present enemy which is attacking metallic wealth with ever increasing ferocity and destroying billions of dollars of manufactured items each and every year.

There are several ways to fight this attack, principally by painting, plating, chemical treatments, porcelain enameling, vapor phase inhibitors, and specially prepared oils, greases and solvent mixtures.

In order to fight corrosion, it is necessary to understand the simple basic features of electrochemical corrosion. In order for corrosion to proceed, there has to be set up an electrochemical cell consisting of four parts:

1. Anode
2. Cathode
3. Electrolyte
4. Connecting circuit.

The purpose of any protective coating is to interfere with the above mentioned electrochemical cell.

In the processing of manufactured goods produced by steel mills, economy is of prime importance because of the tonnage involved. An economical way to prevent corrosion is by the use of special types of rust inhibited oils, greases or solvent dispersions.

The Department of Defense has been one of the prime movers in the development of rust preventive compounds and much is owed to such laboratories as the U. S. Naval Engineering Experiment Station, Naval Air Material Command, Wright-Patterson Air Force Base and Rock Island Arsenal. Their work during the war and after has led to many improved test evaluation methods, packaging procedures and protective coatings.

The laboratory personnel use such accelerated test methods as the salt spray, humidity cabinet, and weather-o-meter. These tests are at the best good screening methods, and the "acid" test of any protective coating is actual mill or field experience.

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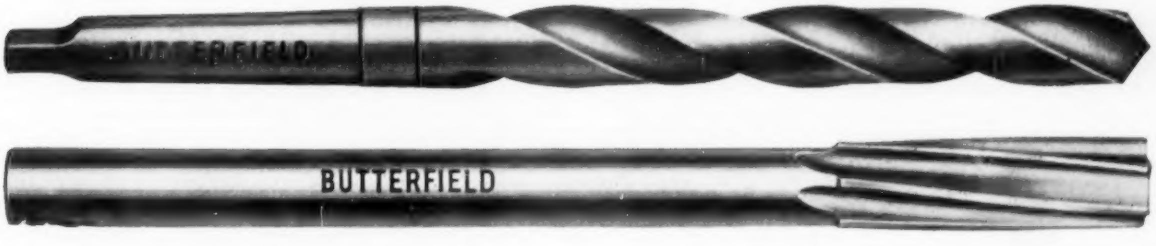

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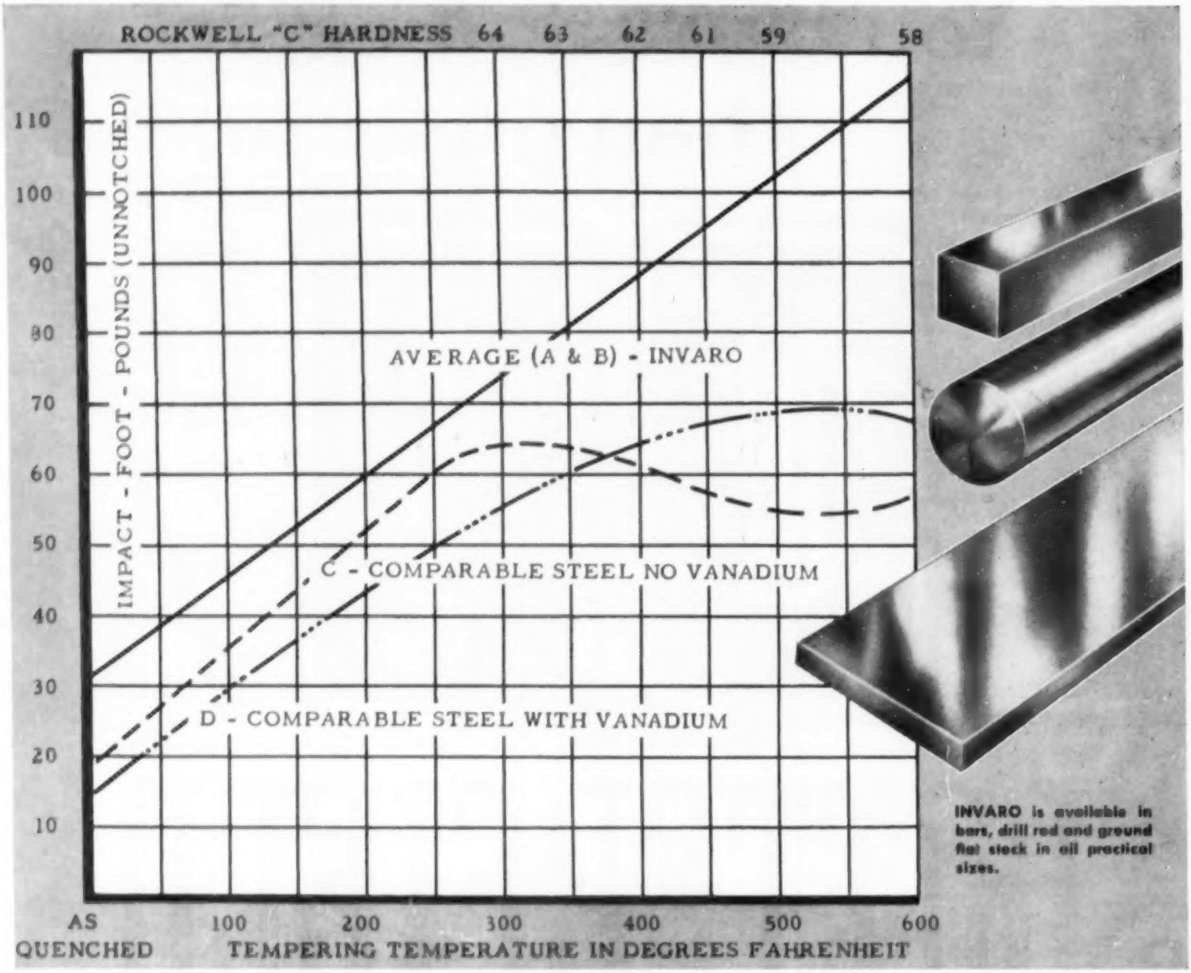

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Invaro B	.94	.25	1.20	.014	.013	.53	.22	.49
Comp. C	.90	.33	1.24	.011	.025	.50	—	.55
Comp. D	.95	.34	1.27	.010	.020	.50	.21	.59

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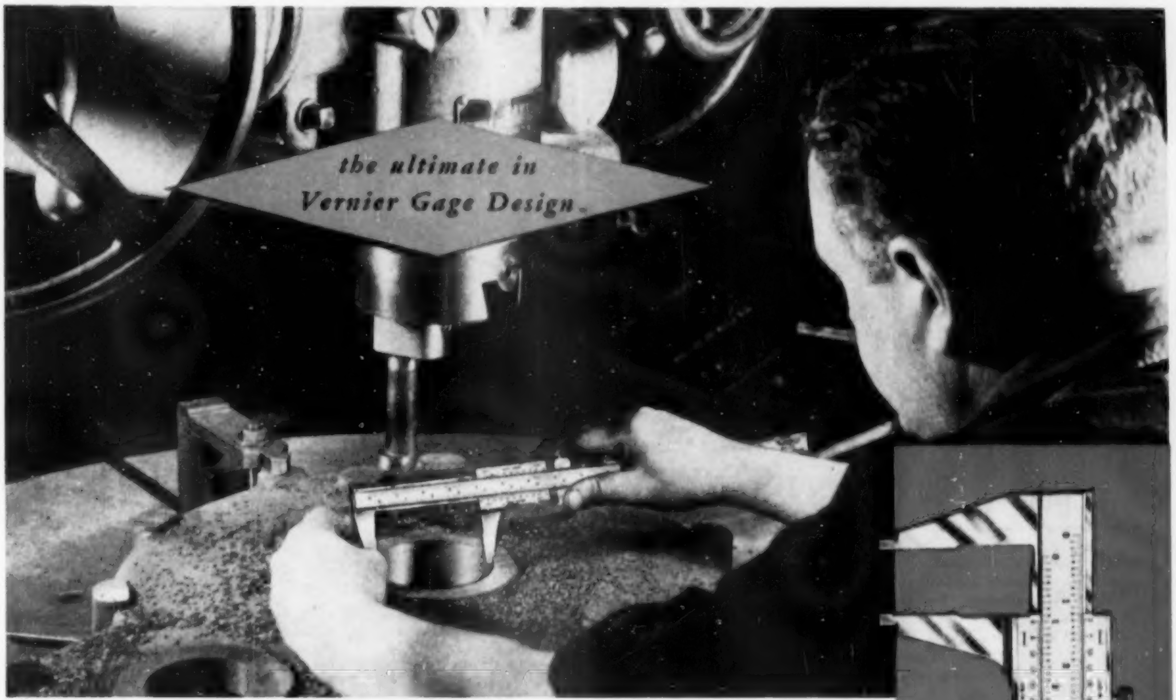

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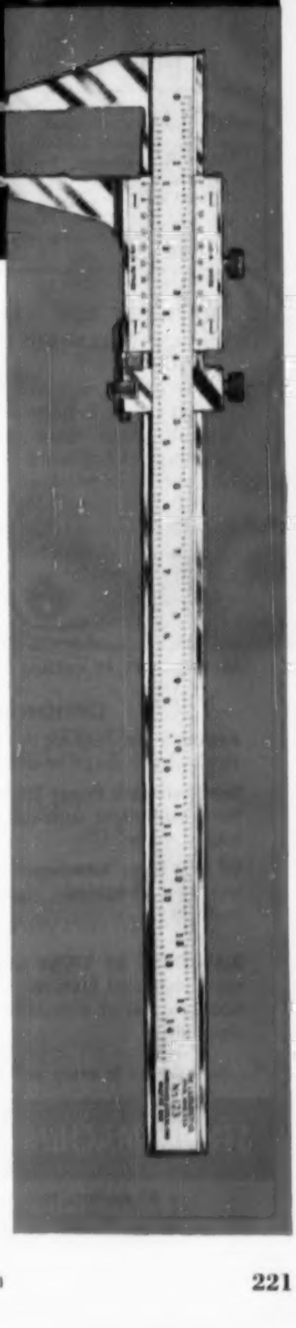

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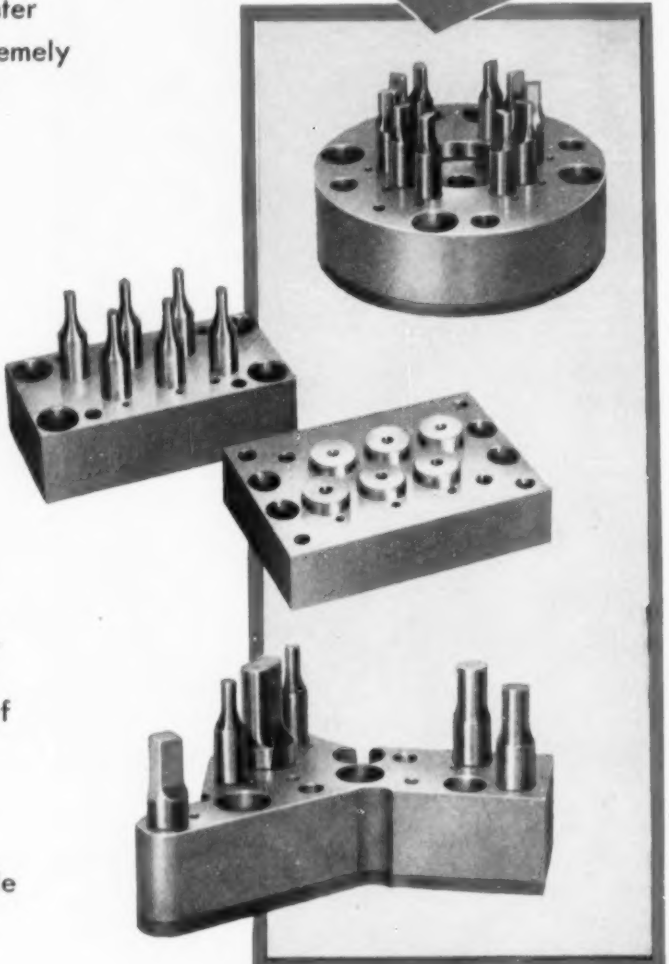
On many punching operations, close center to center hole spacing in work and extremely fine tolerances must be held. R-B makes special retainer plates that will hold punches and die buttons exactly to your spacing specifications.

Any shape, size or number of punches and die buttons can be incorporated in the designing of your special R-B retainer plates. Also, ball locks are built into each special retainer to provide the same quick radial and vertical locking of punches and die buttons found in standard R-B retainers.

Special R-B retainer plates are made of tool steel which is precision ground after hardening. You will save skilled man hours in die construction and maintenance by using these multiple hole retainer plates. Result—more work completed each day and increased profits for you.



Use R-B Engineering Service
for your Piercing Problems

For Additional Information or Engineering Service, Write to:

RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION

DEPT. 91 • 26490 CAPITOL AVENUE • DETROIT 39, MICHIGAN

For almost any internal grooving problem . . .

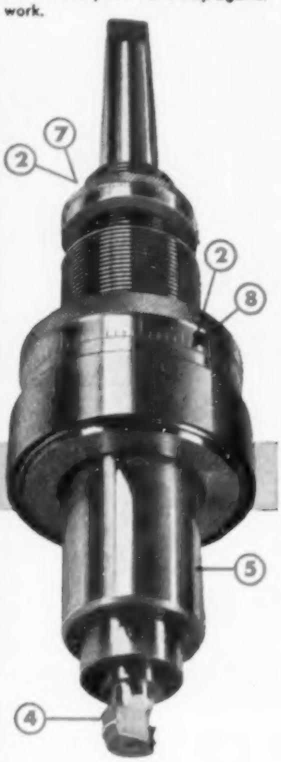
PREMIUM QUALITY RECESSING TOOLS

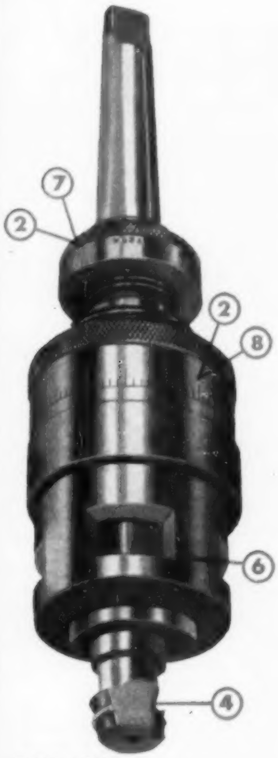
DESIGNED BY SCULLY-JONES TO CUT CAPITAL AND OPERATING COSTS

These benefits	. . for these reasons	. . result from these PREMIUM features
REDUCE COSTS	Minimize need for special machinery.	1. Simplify intricate recessing and grooving operations on standard machines, such as drill presses, radial drills, turret lathes, and chucking machines.
	Reduce skill requirements and labor costs.	2. Position tool and control depth of cut automatically.
	Eliminate downtime.	3. Hardened and ground parts assure long life and trouble-free operation on precision work.
	Cut tooling costs.	4. Interchangeable tool bit holders or circular form cutters easily and quickly adapt tool for a variety of special operations.
		5. Hardened and ground steel pilot fits standard bronze bushing.
		6. Interchangeable hardened and ground steel pilot or stop collar made to suit specific requirements. Stops against and pilots in work.
INCREASE ACCURACY	Simplify accurate settings.	7. "Quick-Lock" nut sets depth of undercut to within .001 in.
		8. Adjustable stop collar assembly locates position of undercut in hole to within .001 in.
INCREASE PRODUCTION	Speed operations.	9. Adjustments controlling location and depth of groove are simple and fast.
		10. Positioning of tool and cutting cycle are fast and efficient.

TYPES "J" AND "C"

Pilot in fixture bushing. Can be modified to pilot in and stop against work.





TYPE "R"

Pilots in and stops against workpiece.

SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1915 South Rockwell St., Chicago 8, Ill.

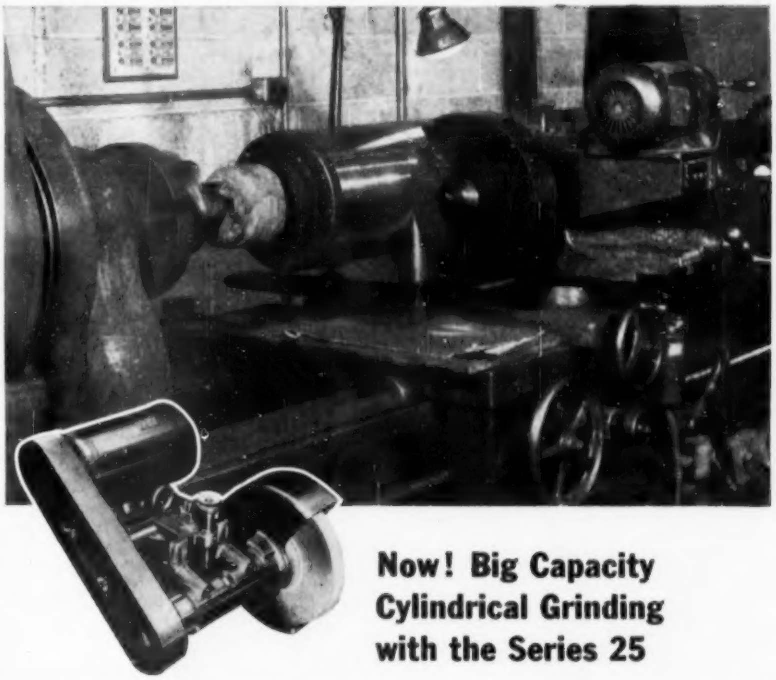
Hand Grinder Speeds Gear Finishing

Making gears of all sizes and shapes is one phase of the business of the Wisconsin Axle Division of Timken-Detroit Axle Co. During manufacture, burrs occur which must be removed for precision gear performance.

This is a painstaking, exacting job which can only be done by hand work. The tool used must have the ability to reach into every nook and tiny corner of the gears. It must be reasonably light in weight, easy-to-handle and have sufficient sustaining power to enable it to be used at day-long intervals, if necessary. Cool operation must also be provided for. Versatility in wheel capacity is another requirement. In short, the tool used should be designed and engineered to provide flexibility in use with a reasonably long life expectancy without excessive maintenance.

To meet these strict requirements, the workmen are equipped with Dumore Hand Grinders. They use these grinders to deburr not only the gears shown, but every big and little gear made by the company. These grinders have repeatedly proved their ability to provide this manufacturer with an efficient, low-cost deburring operation.

The particular hand grinder used is the Dumore Series 10 model. It is recommended for burring, as well as tool and die work, pattern making, production bench grinding, filing and a host of other work. Positive spindle rigidity, forced cooling and quick-change chuck. Universal motor, idles at 22,000 rpm. For further information on this and other Dumore Hand Grinders for high precision grinding at low cost, write to The Dumore Company, 1300 Seventeenth Street, Racine, Wisconsin.



Now! Big Capacity Cylindrical Grinding with the Series 25

DUMORE TOOL POST GRINDER

MOUNTED ON THE COMPOUND . . . of a 20" lathe . . . the Series 25 Dumore Tool Post Grinder provides Bird & Son, Charleston, So. Carolina, with an extremely low cost precision cylindrical grinder for refinishing large rollers.

Grinding is necessary to maintain an extremely smooth finish on big steel rollers required in production operations. Formerly, the work was farmed out to the only available supplier. However, lengthy work scheduling by this single source, transportation time delays, and high costs, proved unsatisfactory.

With the Series 25 Dumore Tool Post Grinder mounted on a 20" lathe, these 12" diameter, 60" long rollers are finish ground regularly in their own plant in one eight-hour day, including loading and unloading. This easily obtained, low-cost, precision grinding equipment has now given Bird & Son the advantages of minimum production delays and lower maintenance costs.

With a 3 hp., 3-phase induction type motor, the Series 25 Dumore Tool Post Grinder is the ideal tool for heavy grinding. 12" wheel capacity. Efficiently hogs away metal or finish grinds. Rugged cast-iron frame assures rigid vibration-free performance. Quill has grease-sealed, lubricated-for-life, precision roller bearings for operation in any position without special oilers. Special patented sealing rings protect bearings during wet or dry grinding.

MOUNTS ON *ANY BASIC* MACHINE TOOL . . . 20" or larger lathes, planers, shapers, boring mills . . . to provide precision grinding equipment at low cost. Simplified mounting makes change-over quickly.

WARNING: If you own a Dumore Tool Post Grinder — don't let it sit idle in your tool crib! It's the most versatile, useful tool you own. Put it to work **NOW** — you'll save money and get better results!

Tool post grinders are available in other sizes to use on smaller machines for every type of job. Ratings range from 1/4 to 1 hp. For complete details write for Full Line Catalog 55 FL.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

You can do more grinding with Dumore Grinders on **any** machine tool!

DUMORE

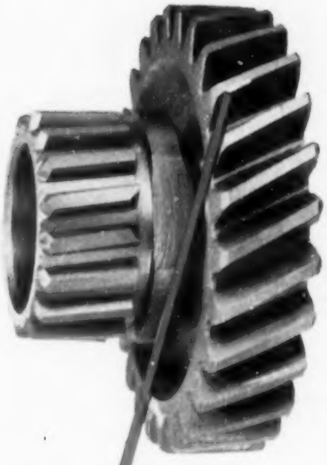
PRECISION TOOLS

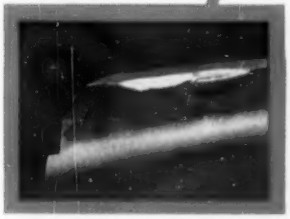
AUTOMATIC DRILL UNITS
TOOL POST and HAND GRINDERS

1310 Seventeenth St., Racine, Wis.

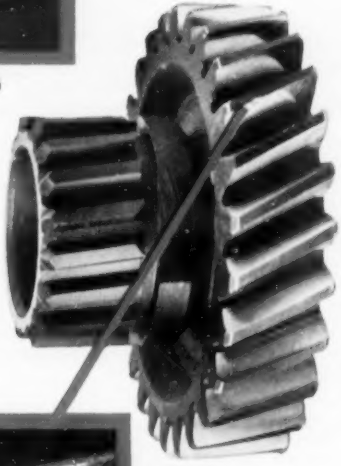
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-233

RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS





Nicked Gear Tooth



Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

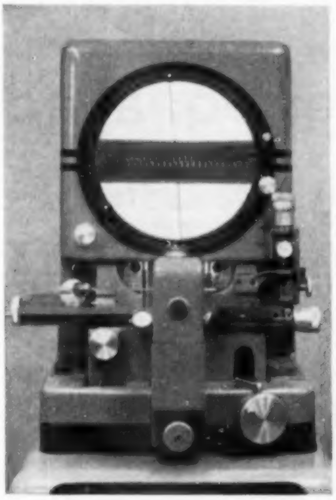
7631

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-237

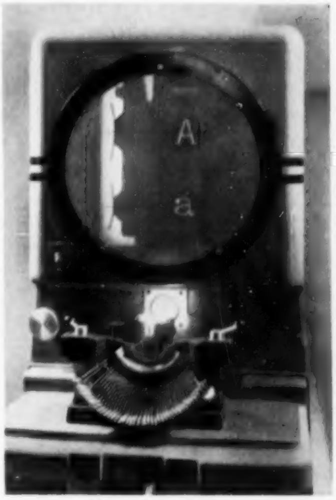
How many places in your plant can projection gaging save time and money?

In the toolroom? Look at this. Prior to adopting projection gaging, a Midwestern manufacturing plant required 725 man-hours monthly to inspect flat drills, taps, special cutters, and circular form tools. Use of a Kodak Contour Projector reduced inspection time 84% to 115 man-hours; cost of the projector was returned in direct labor savings within three months. If you have a heavy inspection load in your toolroom, chances are that optical gaging with Kodak Contour Projectors could effect similar savings for you.

In receiving? Here's the experience of a leading maker of aircraft engines. Their gaging procedure on jet engine blades called for inspecting 11 dimensions (including radii and angles) on the dovetail contour, 14 additional dimensions on the blade root. Using two Kodak Contour Projectors, they checked these pieces at a rate of 150 per hour. And operators required little training. What about your receiving inspection department? Couldn't a fast, highly accurate method of inspecting all sorts of parts with multiple dimensions and complex shapes help prevent bottlenecks?



In production? A lot of people don't think of optical gaging in terms of production inspection. A typewriter maker did. To check the alignment of type bars to ±.0002", they placed a Kodak Contour Projector next to the soldering jigs on which bars are mounted on their arms. Catching errors at this point and correcting the jigs reduced alignment time in final assembly 25%. Install Kodak Contour Projectors next to production equipment and you have a fast, continuing check that insures machine settings are correct. That's a good way to keep scrap costs down and quality up.



In final inspection? Ever have a part that was almost impossible to inspect accurately and completely? A leading West Coast electronics manufacturer did. They had to check the precise pitch of a fine wire helix mounted in its glass tube. "Without the Kodak Contour Projector," the company reported, "it would not be practical to make the measurements necessary to get a satisfactory instrument." Many times optical gaging on a Kodak Contour Projector lets you measure small or easily distorted parts with a simplicity and accuracy you can't achieve by other methods.

WHATEVER your inspection or measuring problem, there's a Kodak Contour Projector to do the work, from the bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

To find out more about how optical gaging can save you time and money, improve accuracy, send for the booklet, "Projection Gaging with Kodak Contour Projectors." Write *Special Products Sales Division.*

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-239

From coast to coast there's no grinding wheel service like Norton

For Your General Purpose Grinding or Your High Production Jobs

PACIFIC OCEAN

ATLANTIC OCEAN

Norton Nation-Wide Service Is Complete

Your Norton Distributor is one of over 315 in the United States. His men are trained to help you in grinding techniques and wheel selection. Also, he's ready to call in a Norton Abrasive Engineer for expert aid in any of your complicated grinding problems. His sizable grinding wheel stocks are fitted to the needs of his area — and they're backed by the world's largest stock, located in five Norton warehouses, as well as at Norton's Worcester headquarters. Norton manufactures grinding wheels on both coasts, at Worcester, Massachusetts and Santa Clara, California.

Norton Wheels Meet Every Possible Need

Norton makes a *really* complete line of grinding wheels to save you time and money across the widest range of grinding jobs . . . adding the same profit-boosting "Touch of Gold" to your general purpose grinding as to your production jobs. Norton wheels are made in every abrasive-and-bond combination you need, including the new, revolutionary 44 ALUNDUM* abrasive that's tops among all non-premium priced aluminum oxide abrasives.

Get These Facts and Prices

The new catalog *Norton Grinding Wheels*, Form 1052, brings you a lot of general purpose information and describes wheel specifications that will bring you best results. Every item in this catalog is available from stock. Included is a new supplement showing net prices. Get one from your Norton Distributor. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**

NORTON ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes

*Trade-Mark Reg. U. S. Pat. Off and Foreign Countries

W-1768

"*More Use per Dollar*" With MANHATTAN CUT-OFF WHEELS

In factories where records are kept, Manhattan Cut-Off Wheels have proved they do a better, cleaner cutting job . . . and last longer than any other wheels! Exclusive Manhattan developments in both rubber and resinoid bonds account for this greater cutting efficiency and longer service life. Every Manhattan wheel is custom-bonded for your specific cut-off job . . . to give you cleaner, cooler cutting at higher machine speeds whether you work with hardened or soft steels, light gauge tubing or critical alloys. Safe, fast, clean cutting over sustained periods of time saves you time *and* money . . . improves quality of production.

Manhattan Cut-Off Wheels are made to your order in the widest range of types and sizes. Manhattan Portable Wheels, Moldiscs, and Centerless Wheels are also custom-made for specific operations at your plant. Let a Manhattan Abrasive Wheel engineer show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty abrasive wheels.

RM742

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

R M

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

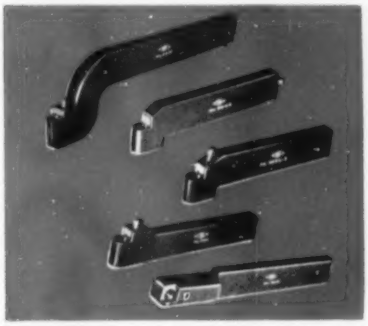
The OK TOOL Story

METAL CUTTING TOOLS . . . FROM ART TO SCIENCE

At the turn of the century, The O. K. Tool Company initiated and lead the transition of tool making from an uncertain art to a precision manufacturing science.

This transition, still in process, took its first big step in the development by the O. K. Tool Company of a complete system of interchangeable inserted tool bits, preforged, preground to the exact geometry and prehardened.

For the first time in history, the American manufacturer could purchase for immediate use tool holders and a selection of bits for precise and efficient operation on lathes, planers, shapers and boring mills.



In 1901 O K Tool introduced the first tool holders with systematized tool bits . . . interchangeable, hardened, ground, ready for immediate use.

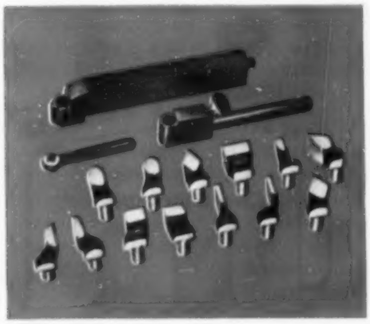
He had at his disposal the proper size and design of holder for his particular machine tool and a large selection in size and shape of interchangeable bits best suited for his operation.

Trade name steels of uncertain quality gave way to tools carefully specified.

Hand forging was replaced by accurate machine forging.

Precision grinding replaced off-hand grinding.

Blacksmith hardening went out, and precision controlled heat treating came in.



Tool sets for lathes, planers, shapers, boring mills, mean great savings to the metalworking industry. Forged alloyed steel holders conserve tool steel for tool bits. This combination better withstands the stress and strains of cutting action.

The industry had taken its first important step in its goal of supplying better tools for less money.

The next important step, again taken by The O. K. Tool Company, was the development of a milling cutter with inserted interchangeable teeth.

It was constructed essentially by locking O. K. high speed steel shank type tool bits around the periphery of a disc of alloyed cutter body steel. It was costly to manufacture and inefficient in operation but it was nevertheless the foundation that underlies every type of inserted blade cutter made in America.

Although it was improved from time to time, it became apparent that it was basically incapable of being developed to the extent where it could fully meet the growing demands of American Production.

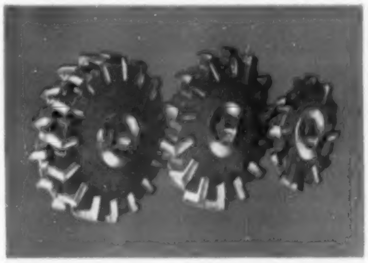
Several designs of inserted blade cutters appeared on the market, but they also lacked simplicity and rigidity.

The O. K. Tool Company, under the Ritchie Patents, then developed the simplest, strongest and most rigid cutter ever made. It still holds that distinction today.

The blade of this cutter is a 5 degree tapered and serrated wedge which functions both as cutting unit and as locking device.

No pins, screws, wedges or other auxiliary locking devices are required. The blade is truly a self-locking cutting unit.

The O. K. cutter has been imitated but never equaled in design, quality and the engineering service that goes with every sale.

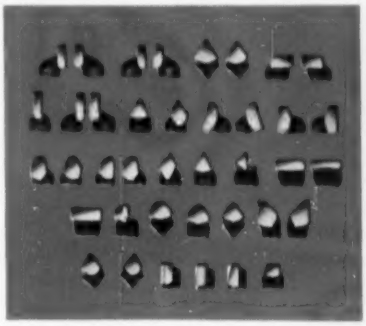


The O K line includes inserted blade milling cutters, end mills, face mills, reamers, counterbores, boring heads, and other multiple-bladed cutters.

This design is used in face mills, slotting cutters, half side mills, end mills, reamers, etc.

Since no auxiliary devices are required, it permits the maximum number of blades in any type of cutter. This often is the only type of blade possible in small diameter end mills and reamers and in special multi-diameter tooling so widely used today.

The next "first" developed by the O.K. Tool Company was the development of the serrated tool bit. This was a natural extension of the serrated blade principle, to lathe, planer and shaper tools.



Shankless tool bits, prehardened and preground, come in 43 standard shapes and in various metal-cutting materials. Holders and bits are made in three sizes for medium, heavy and extra heavy-duty.

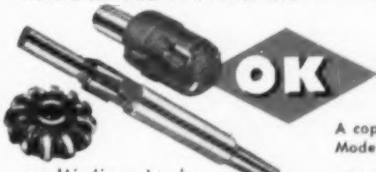
This permits side adjustment of the bit to compensate for wear, which permits maximum use of the tool material.

This series of tools is supplied in many sizes and shapes for maximum performance for light, medium and very heavy work.

The O. K. blades and bits are supplied in a variety of metal cutting materials to best fill all metal cutting requirements. They are available in several types of high speed steel, the cast alloys and the carbides.

In the manufacture of cutting tools, the transition from art to science is still progressing. The arts established the foundation, and will never be abandoned, but it seems apparent that future guidance will be chiefly in the hands of science.

THE O K TOOL COMPANY INC 300 ELM STREET MILFORD NEW HAMPSHIRE

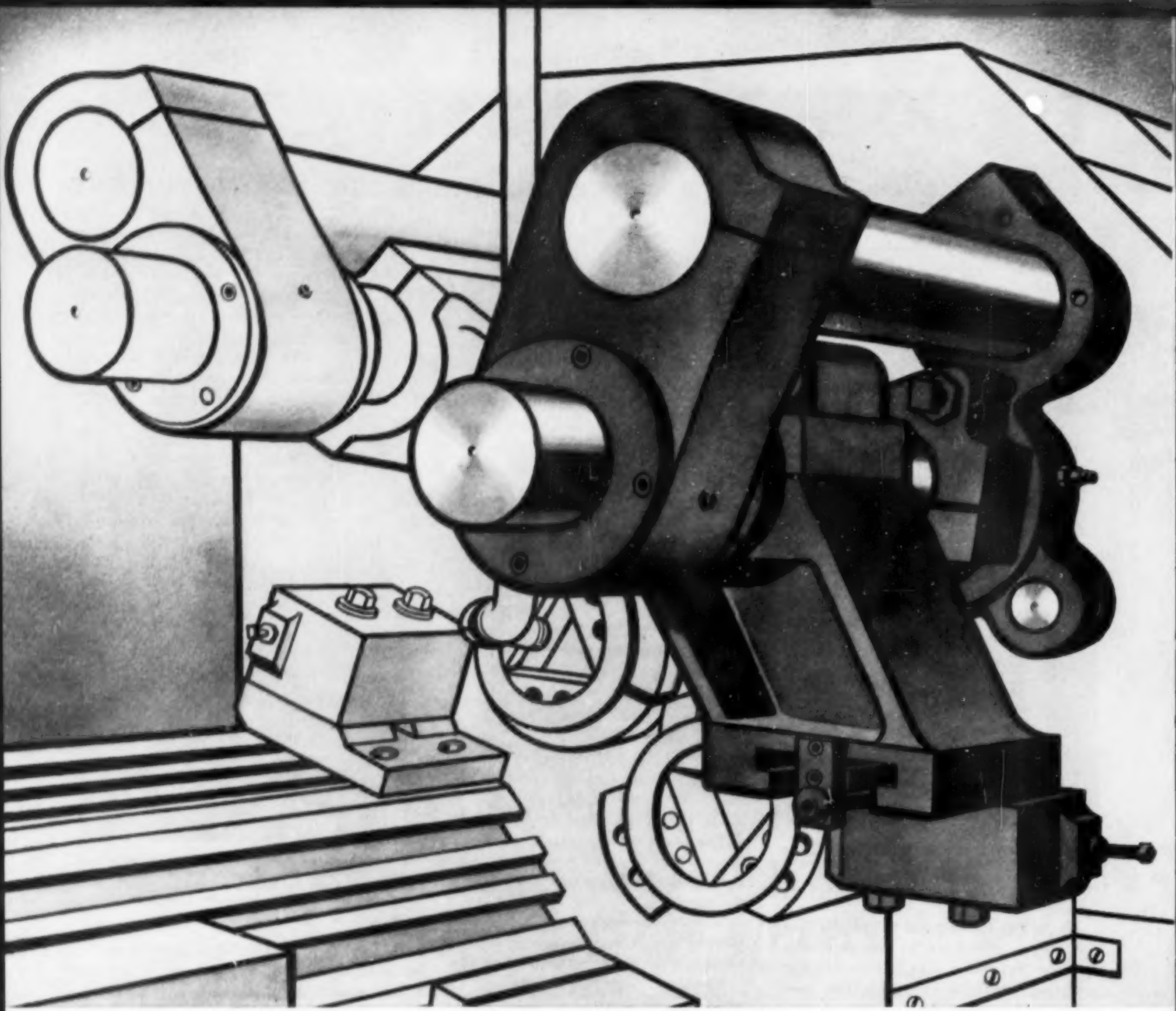


multi-diam tools

modern milling cutters for modern milling machines

A copy of the OK catalog 13, "Modern Milling Cutters for Modern Milling Machines" is yours on request.

reamers • boring heads • form cutters



3 money-making advantages

from 1 exclusive New Britain feature

New Britain's exclusive swinging arms can do everything a cross slide can do, *and*:

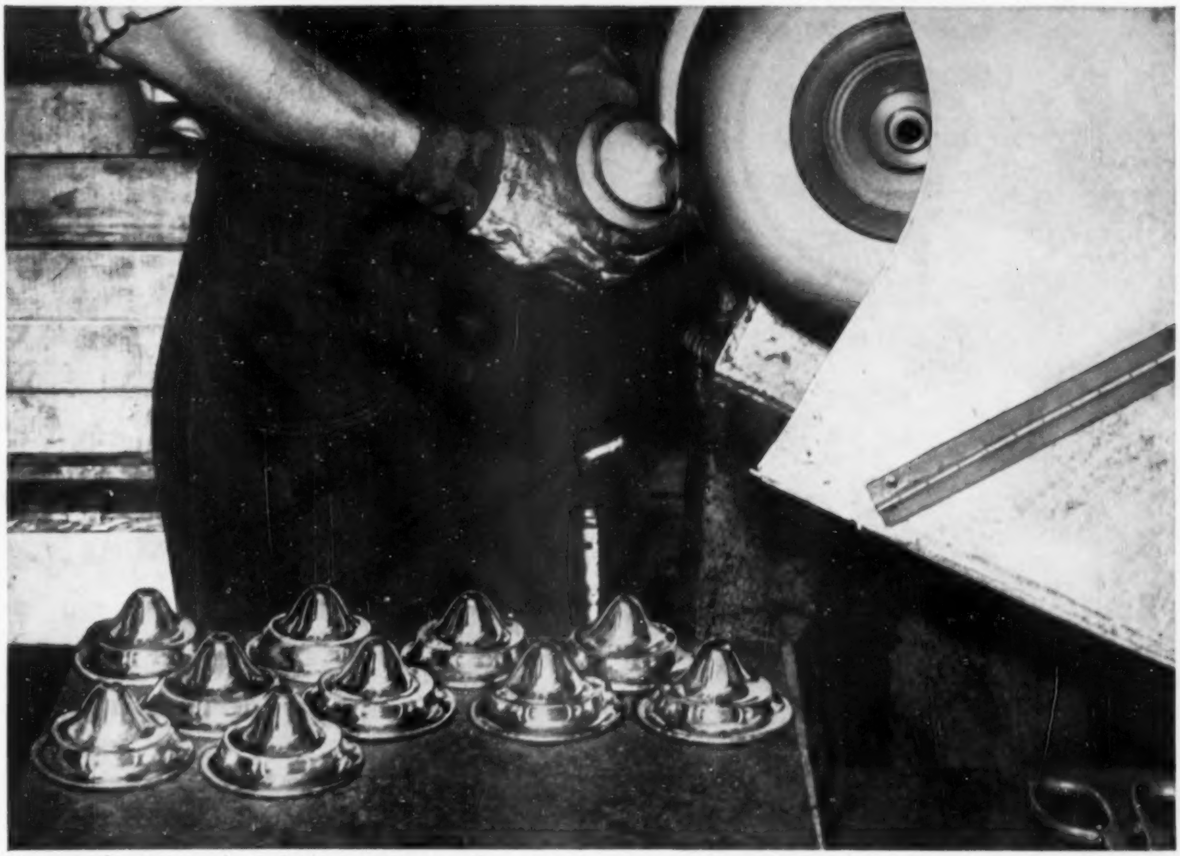
- You can position them for any length piece.
- You can turn O.D.'s and I.D.'s and faces with single point tools.
- You can *combine* transverse and longitudinal motions to turn tapers or radii and do recess boring.

Before you invest in automatics, check New Britains. Their "do more" principles can produce a greater return — often it's the difference between a single machining and the need for secondary operations. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.

Automatic Chucking Machine

NB



THE BASE of a Huntercraft Candelabra Model 8008 (shown below) requires, with Formbrite, only a finish buff. The base is formed in two drawing operations. The deeper drawn candle cups, also of Formbrite, need only a light cutting with Tripoli and a finish buff.

It's easy to get a jeweler's finish with Formbrite

HUNTERCRAFT Table or Wall Candelabra Model 8008, one of 30 fine brassware items in the line of Huntercraft Originals.

"Formbrite cut polishing cost and time dramatically—was a major factor in keeping our small business alive . . . and growing," says Ralph E. Hunter of Huntercraft.

THE production of Huntercraft Originals—now a nationally distributed line of fine brassware—has grown from a basement hobby to a thriving new business in less than 5 years.

The Hunter Machine Service Company of Racine, Wisc., began manufacturing Huntercraft Originals on a commercial scale in 1951, using ordinary soft forming brass. To get the gleaming jeweler's finish required, polishing time and costs were high. In fact, they were so high that the young company found it impossible to bring their prices into line with competition.

In 1953, they tried Formbrite® Anaconda's superfine-grain drawing brass. The polishing bottleneck was broken and production soared – unit costs went way down. According to Ralph E. Hunter, owner and president of Hunter Machine Service Co., Formbrite was a major factor in keeping the company alive and enabling it to go on to become a stable, growing business. The finish obtained so easily on Formbrite, he adds, is superior to that achieved on ordinary drawing brass.

Formbrite is a premium product at a nonpremium price. Find out for yourself how its superfine-grain, excellent drawing properties, strength, and scratch-resistance can help you make a better product at lower cost. Write for Publication B-39. Better yet, ask for a sample or a trial batch. Address: The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Formbrite SUPERFINE-GRAIN DRAWING BRASS

an ANACONDA® product

made by The American Brass Company

Set No. 84

VK GEAR MEASURING WIRES

Illustrated above is the newest Van Keuren Gear Wire Set No. 84

Set No. 84 is a multi-purpose set designed to cover a range of 26 diametral pitches from 2 to 80 with wires from each of four different and popular wire series:— 1.92, 1.728, 1.68 and 1.44. Because of duplication of wire sizes, this set which would normally involve 104 sizes reduces to 84 sizes. The economy here is evident.

The latest VK Gear Measuring Tables, available in Catalog and Handbook No. 36, have been arranged for use with all four of these gear wire series. Thus the set can be used in conjunction with the tables in many ways, such as:

Tooth Thickness — Measuring *tooth thickness* of internal and external spur gears, splines and serrations.

Involute Profile — Checking *involute profile* by using more than one wire size. Series 1.92, 1.728 and 1.68 for externals. Series 1.68 and 1.44 for internals.

Helical Gears — Measuring *helical gears* when normal diametral pitch is one of the 26 for which the set was designed.

Enlarged Pinions & Reduced Gears — Measuring *enlarged pinions* and *reduced gears*. (tables are now available for the first time in VK Circular G38, giving measurement values and change factors for reduced gears which mate with pinions enlarged in accordance with the latest American Standard covering involute fine pitch gears).

Complete information regarding the use of gear measuring wires is contained in a fifty-page section of the VK Catalog and Handbook No. 36. Included in this section are the most complete gear measuring tables available, as well as all necessary formulas and equations for computing non standard spur and helical gears. Numerical examples are included. This book is available on request.

VK Gear Wires are held within .000025″ for roundness and exact size. Surface finish is 1.5 RMS or better.

If complete coverage of all series is not necessary, sets covering single series such as 26 Ex. or 26 Int. are also available. See Catalog No. 36.

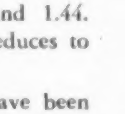
VK

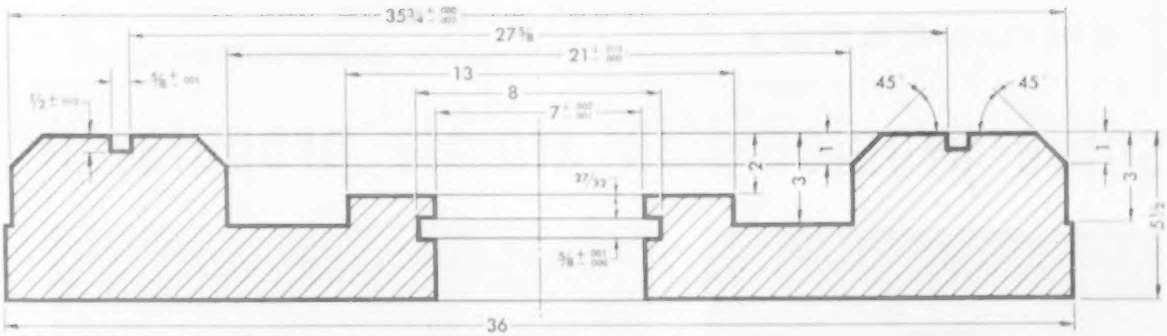
38TH YEAR

THE Van Keuren CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

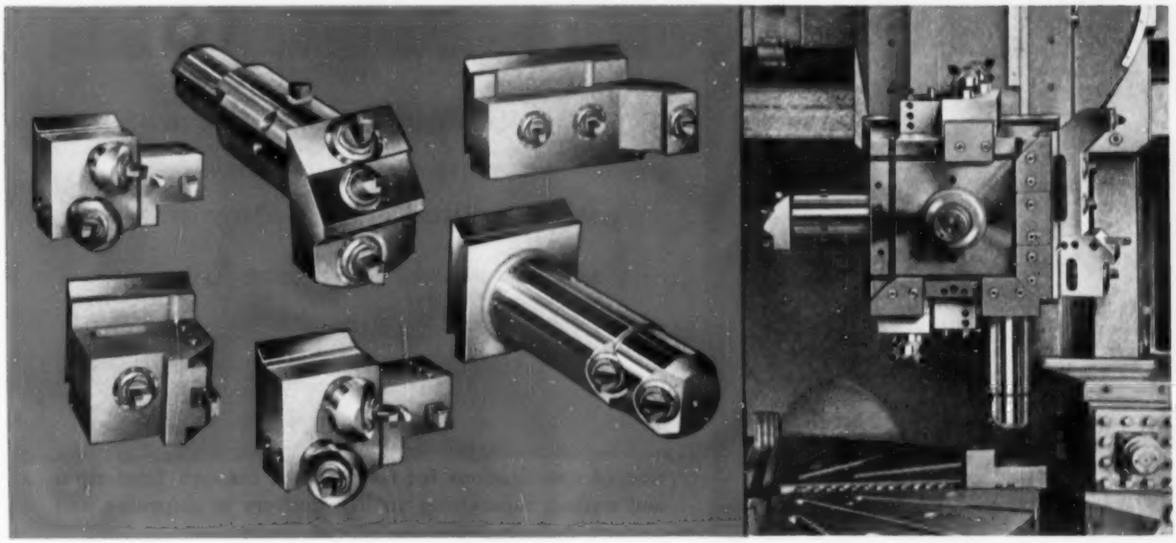
Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.





Certainly you can use Microbore Tooling on a Vertical Boring Mill

HERE'S HOW KING DID IT!



24 OPERATIONS BY CLUSTERING MICROBORE UNITS IN 6 BARS

• This tooling for a difficult job was designed and made by the Microbore Division and was used with great success by the King Machine Tool Division of American Steel Foundries. Notice that boring, facing, chamfering, turning and grooving operations were required and precise limits were held.

• The simple setup and quick adjustment of each individual Microbore unit resulted in a minimum of down time. This is typical of reports from shops where the Microbore System is used. Microbore is a basic tool which can be applied singly or in clusters for all types of precision boring, turning and facing operations.

• Proposal engineering from your prints and machine data is a unique feature of the DeVlieg Microbore System. Discuss your tooling problems with our specialists or let us send you our informative catalog.

DEVLIEG MICROBORE SYSTEM

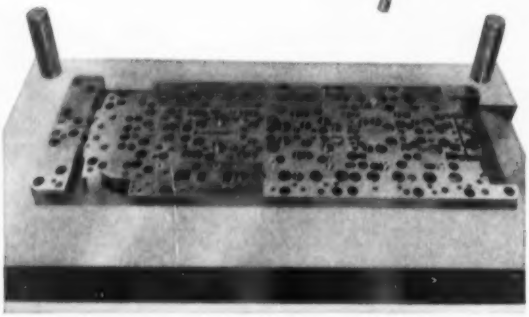
MICROBORE DIVISION • DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

HOLES

JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



A seven station die from Vulcan's contract Tool Room (Your Tool Room in Dayton).

Standard sized punches and buttons were used. But since forming and piercing operations were involved, hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

*Vulcanaire equipment pays for itself on the first job.

Borrow Vulcan's instructive movie on jig grinding

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Engineering, Procesring, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

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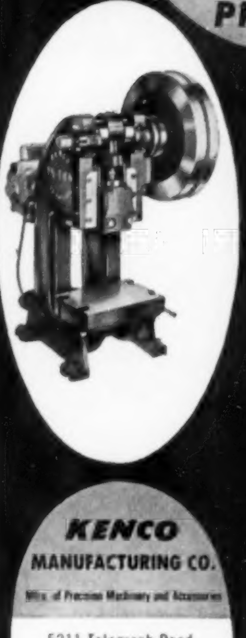
KENCO

1½ TO 15 TON

PUNCH PRESSES



PRECISION-BUILT FOR FAST, TROUBLE-FREE PRODUCTION

Here at last is a complete line of small punch presses built to big press standards. You get rugged construction throughout . . . minimum need for adjustments . . . minimum downtime . . . capacity far beyond the ratings . . . steady, economical production.

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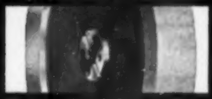
Trouble-free crankshaft has no weakening slots . . . eliminates driving dog breakage. One-piece, alloy steel construction.



Flywheel driving plate is hardened and ground, assuring long wear and positive drive—a quality feature exclusive with KENCO presses.

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Mfrs. of Precision Machinery and Accessories

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Choice of Arm Extensions:
31" (No. 1102)
20" (No. 1103)
Same Price

Now it's as easy to beam light into a recess, or around an offset, as onto a simple tool or bench position. This Adjustable-Arm Dazor with side-mounted reflector offers same low-cost air-cooled efficiency and positive tension control as top-mounted style. Uses 60-w bulb. Call your Dazor distributor. Dazor Manufacturing Corp. St. Louis 10, Missouri.

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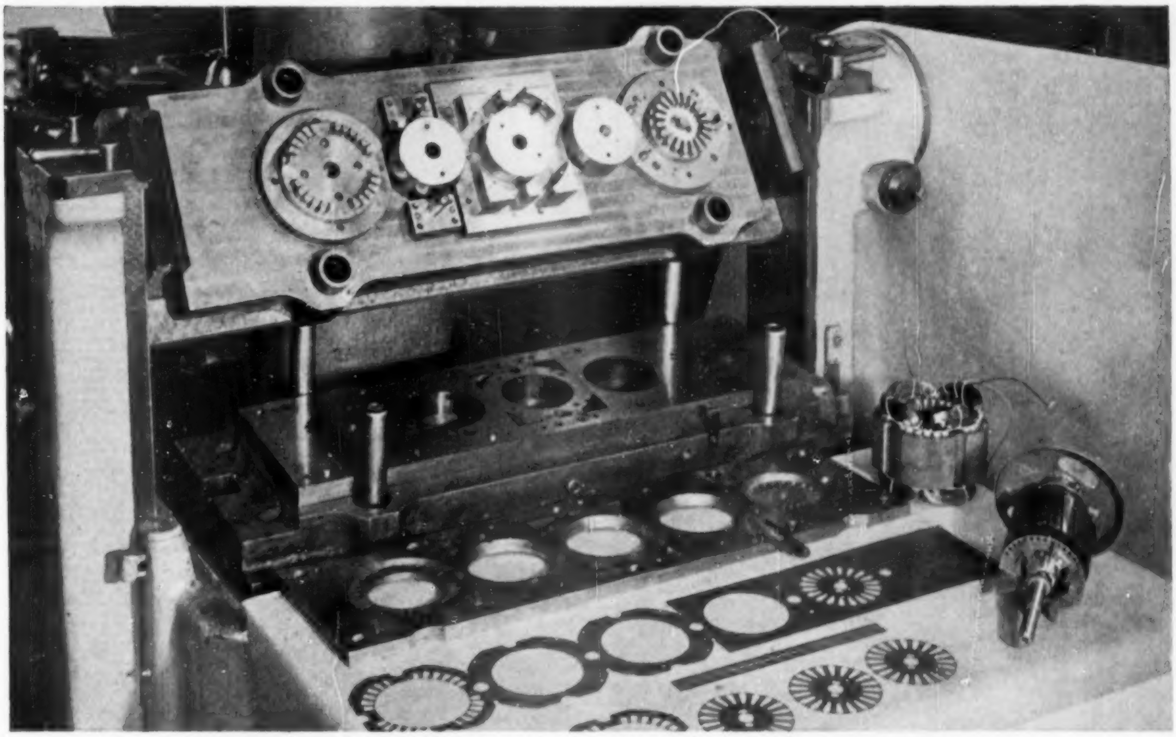

LIFE magazine selected the Ehrhardt punch and die above to illustrate the Special Feature Series on AMERICA'S ARTS AND SKILLS, Part IX: Beauty in the Tools of Today.

This Ehrhardt die appeared in LIFE magazine ...and here is its "life story"

When a die—even an Ehrhardt die—wins a "beauty rating" in LIFE—that's news. But there's more to *this* success story—*triple plus* tells you how Ehrhardt brought the first precision tooling to the Mississippi—then grew at a rate startling to skeptics in the industry.

The above multi-stage lamination die produces rotors and stators for air conditioning equipment motors. Its complete punch alignment was checked without removing it from this Moore "die Flipper"—one of a complete battery of special machines which guard Ehrhardt's famous precision at each step, and include the latest Elox electrical discharge machining equipment.

If your own tooling ideas encompass even higher orders of precision—if you, too, foresee laboratory exactness soon being demanded routinely—if you'd rather be prepared for tomorrow than caught with your tolerances down—read *triple plus* and be ready.

Ehrhardt/St. Louis accepts and solves problems at a level of difficulty declined by all but an estimated handful of shops in the United States.

Send for the booklet *triple plus* today. Learn how this Ehrhardt concept—full range facilities, plus precision skills, plus unique experience—can add up to a profit story for you.

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HELLER
VIXEN®
MILLED CURVED-TOOTH
FILES
The HELLER VIXEN cuts freer–faster–and produces a smoother finish than any other milled curved-tooth file.
Deep gullets and wide pitch enable chips and filings to drop free–thus leaving a smooth, even finish.
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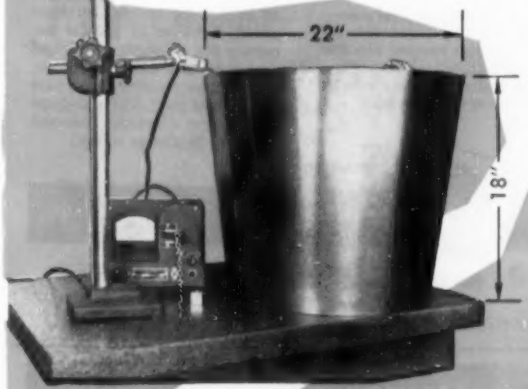
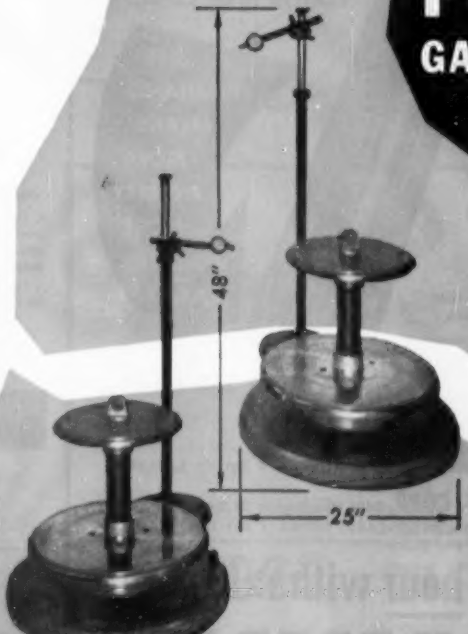
LOOK FOR THE WHITE TANG.
YOUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

Broad Range of Work Requires

BROAD RANGE OF PMCo GAGES

The #00-96 PMCo Thread Ring and Plug Gage appear small beside a 1 inch gage block.





The Pipe Machinery Company's trademark appears on gages from #00-96 HILO thread setting plug and rings, through the 22 inch diameter taper plug shown.

In more than forty-five years of doing business with the pipe, thread, and metal trades, they have become acquainted with the expert craftsmanship available from the Pipe Machinery Company's team of highly skilled personnel. Our range of work is great, and the degree of quality is always the highest. Wherever you find a PMCo gage, you can be sure it is the finest.

THE PIPE MACHINERY COMPANY

29101 Lakeland Blvd. • Wickliffe, Ohio

Greater Cleveland

Get the Pipe Machinery Co. fully illustrated Catalog today. Write us on your letterhead.

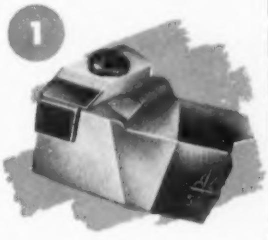
Only ADAMAS DEX-A-TOOL has ALL 4 FEATURES

No other toolholder for "throw-away" inserts gives you as many extras-for-efficiency as DEX-A-TOOL by Adamas!

Talk about *fast* and *easy* to work with — DEX-A-TOOL's got them all beat for quick interchangeability, rapid indexing and fast, accurate chipbreaker location after indexing! And versatile? DEX-A-TOOL accommodates both "thin" (1/8") cutting tips with 1/32" nose radius *or* "thick" (3/16") carbide inserts with 3/64" nose radius!

DEX-A-TOOL's 7 styles and 56 sizes cover the full range of machining conditions! DEX-A-TOOL's precision engineering and many plus features add up to real trouble-free machining! Plan *today* to test DEX-A-TOOL on your own machines.

1



Adjustable chipbreaker

Combination chipbreaker clamp is easily adjustible for lightest to heaviest cuts . . . eliminates the need for a separate chipbreaker for varying feeds.

2

Invertible anvil

Invertible feature doubles life over other anvils . . . gives up to 8 times the life over anvils which are not indexable and twice the life over anvils which are not invertible . . . copper plated, hardened tool steel or carbide.

3

Holds both "thick" and "thin" inserts

"Thick" and "thin" anvils accommodate 1/8" or 3/16" inserts of either carbide or Ceralox (Adamas ceramic cutting tool material).

4

Chipbreaker setscrew

Provides fast, precision relocation of chipbreaker.

There's so much to tell you about DEX-A-TOOL, we've put all the time and money saving facts in a special brochure. Send for your copy now! Address Dept. 231

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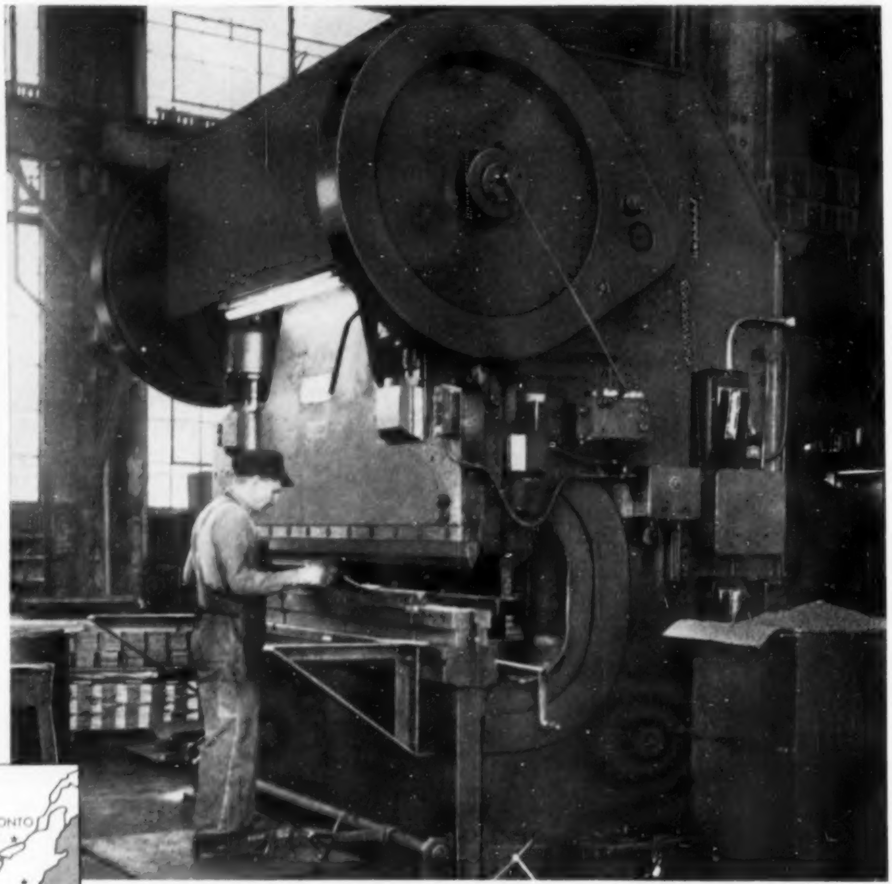

Installed in the Chicago plant in 1948, this 260 ton capacity machine, Model J4½-6, forms the smaller and lighter gauge conveyor panels. Illustrated is a curved section being formed of ⅜" plate to a radius of 8".

STEELWELDS Serve Link-Belt Plants *From Coast-To-Coast*

NINE LINK-BELT Company plants located from California to Pennsylvania, Texas to Ontario, Canada, and in Transvaal, South Africa, have one to six Steelweld Presses and Shears. Nearly every year since 1944 more Steelwelds have been purchased. Slightly over half of the machines are shears.

As a large manufacturer of a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment, Link-Belt plants must shear and form a great amount of steel plate. From experience, Link-Belt has learned that Steelwelds are outstanding for this work.

There are several reasons for this. For instance, the accessibility of controls and ease of making adjustments. The all-around solid construction that permits continuous operation with hairline accuracy. The heavy, well designed machinery which requires minimum maintenance.

Like Link-Belt, when you really get to know Steelweld Bending Presses, you, too, will be elated with their performance.

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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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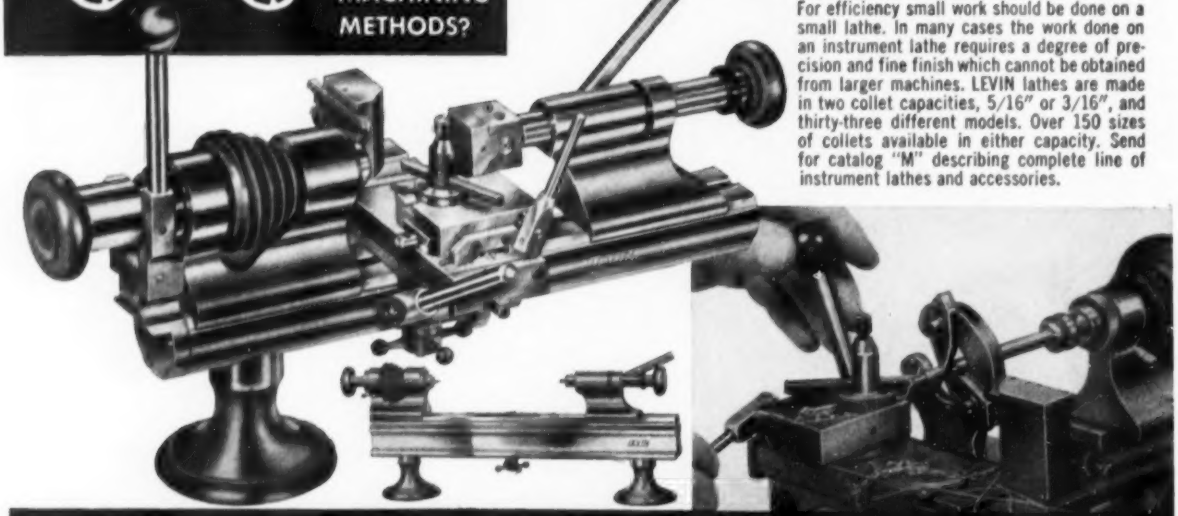
ON LEVIN® INSTRUMENT LATHES

For efficiency small work should be done on a small lathe. In many cases the work done on an instrument lathe requires a degree of precision and fine finish which cannot be obtained from larger machines. LEVIN lathes are made in two collet capacities, 5/16" or 3/16", and thirty-three different models. Over 150 sizes of collets available in either capacity. Send for catalog "M" describing complete line of instrument lathes and accessories.



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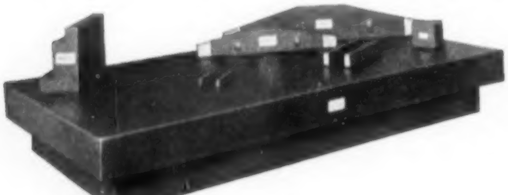

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The place to save money on drill press work

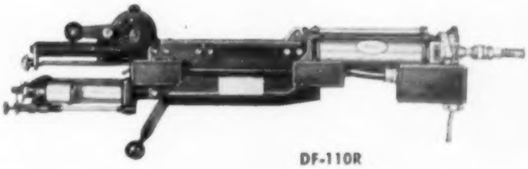
is here

and here

The actual machining time in drilling, tapping, reaming or counterboring is usually fixed by the nature of the tool and material.

But the time taken in getting the tool to and from the material and the material to and from the tool is pretty much up to the ingenuity of the tool engineer. It's here that costs can be cut—added profits made.

It's here that two Bellows "Controlled-Air-Power" Devices can fit into your picture: The Bellows Drill Press Feed and the Bellows Rotary Work Feed Table. The Bellows Drill Press Feed attaches to the star wheel shaft of any standard drill press. A touch on the operating lever and the Feed advances the quill rapidly to the work, feeds the tool under hydraulic control through the work—and returns the quill quickly to starting position. The Bellows Rotary Work Feed Table feeds the parts swiftly, accurately and safely to the tool. All the operator has to do is load and unload—the rest is automatic.



DF-110R

RT-1022

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Quick reading facts that will help you make more money on your drill press operations. Write The Bellows Co., Akron 9, Ohio, Dept. TE-157.

In Canada: Bellows Pneumatic Devices of Canada, Ltd. Toronto, Ontario

Ask for Bulletins DF-110R and RT-1022.

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AKRON 9, OHIO

MANUFACTURERS OF "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION

INCREASE PROFIT MARGIN ON FORMED STAMPINGS WITH U. S. MULTI-SLIDES®

Reduce your costs and increase your profit potential! Elimination of secondary operations and handlings results in reduced costs. It is therefore important to produce parts, wherever possible, complete in one machine. The U. S. Multi-Slide, through a combination of built-in motions, allows for the designing of tools to fabricate precision formed metal stampings without secondary handlings.

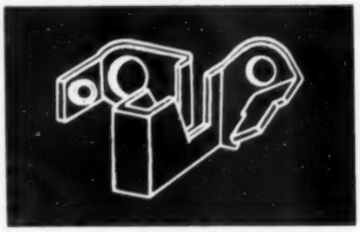
Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position, and a vertical movement for stripping and transferring. Since these movements are part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves. The machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously, as illustrated in the sequence of operations drawing below.

Investigate. Ask for a copy of our Bulletin 15T, or send us part drawings or samples for our recommendations.

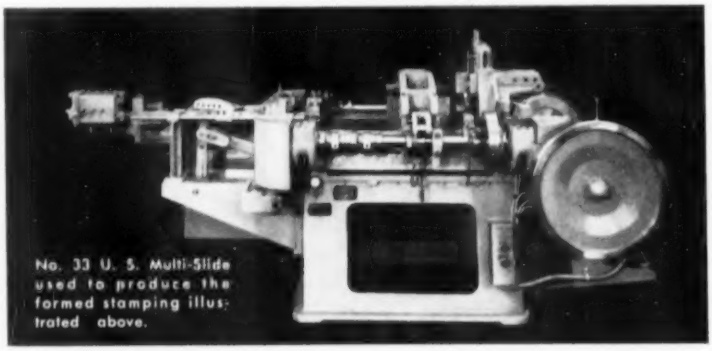
U. S. TOOL COMPANY, INC.

Ampere (East Orange) New Jersey

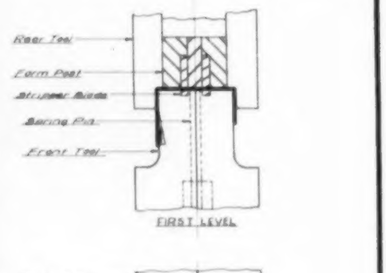
Builders of U. S. Multi-Slides — U. S. Multi-Millers — U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

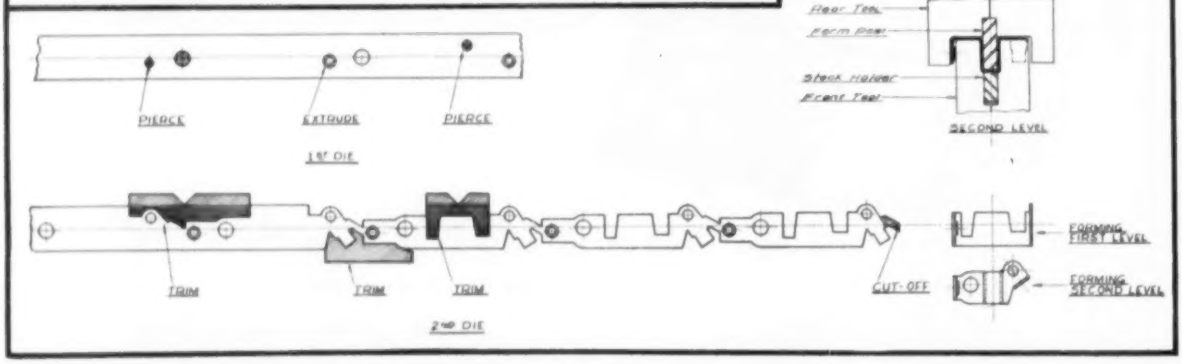


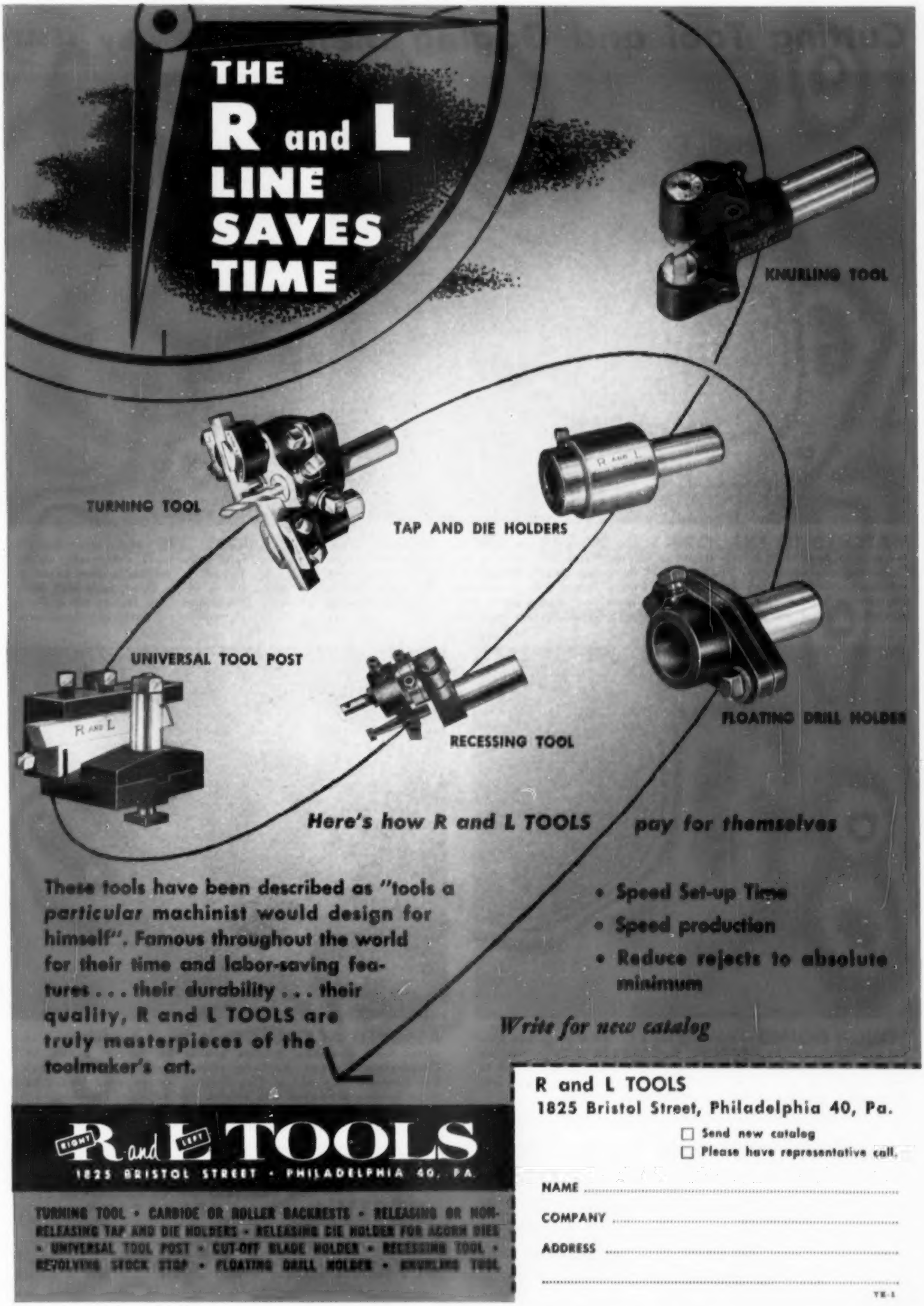
The automotive component shown above is produced complete, without secondary operations, in the No. 33 U. S. Multi-Slide Machine. Drawings below indicate the sequence of stages in the dies and forming positions. Observe the two-level forming position used to complete the piece after cutting off.



No. 33 U. S. Multi-Slide used to produce the formed stamping illustrated above.



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R and L
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TIME
KNURLING TOOL
TURNING TOOL
TAP AND DIE HOLDERS
UNIVERSAL TOOL POST
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These tools have been described as "tools a *particular* machinist would design for himself". Famous throughout the world for their time and labor-saving features . . . their durability . . . their quality, R and L TOOLS are truly masterpieces of the toolmaker's art.
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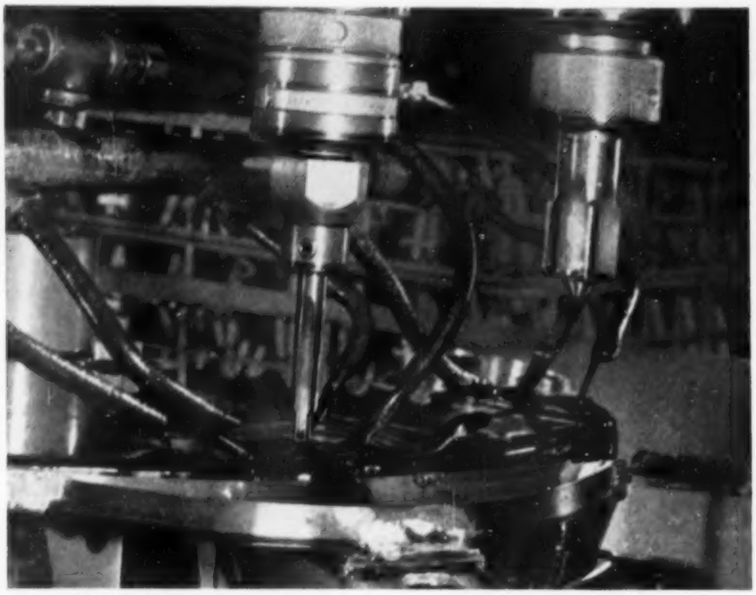
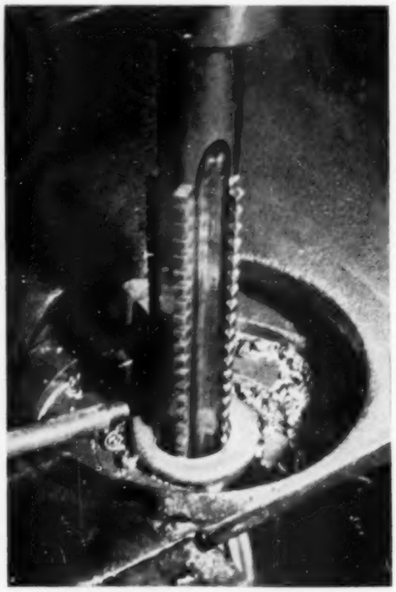
TE-1

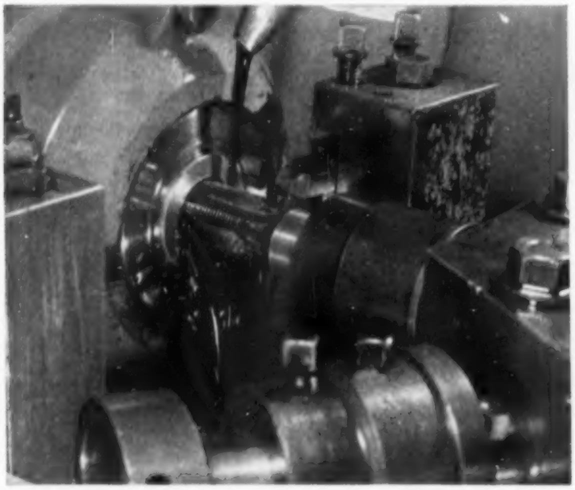
Cutting Tool and Gaging Methods . . . by BESLY



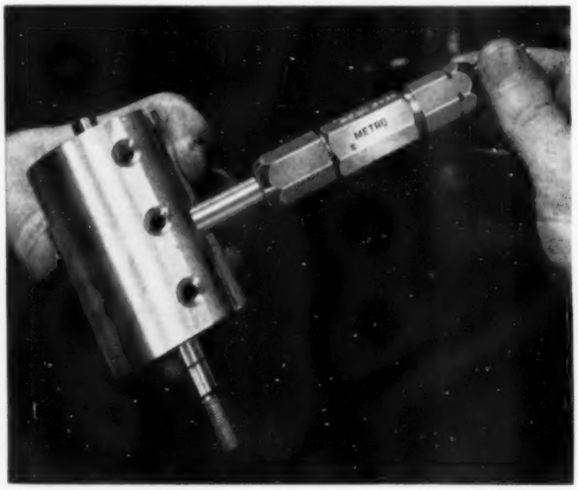
MATCHED TO THE JOB — At The Chicago Screw Company, Bellwood, Illinois, two sizes of Besly taps, poised above an indexing table, are ready to tap C-1141 steel parts. Operating alternately, the smaller $\frac{3}{8}$"-24 Besly tap quickly threads a hole, then the work indexes beneath the $1\frac{5}{32}$"-24 Besly tap and a larger hole is threaded. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were carefully selected and matched to the specific threading requirements.



SQUARED OFF — Templeton, Kenly & Company, Broadview, Ill. cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton screw jacks with Besly Acme Threadform Taps. Notice mirror finish on flutes promoting greater chip clearance.



TOUGH GOING — Here you see a C-1018 high carbon steel nut being threaded by a Besly $1\frac{3}{4}$" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work, proved they could "take it" and were specified by this manufacturer for the job.



ASSURED ACCURACY — To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details or write us . . .

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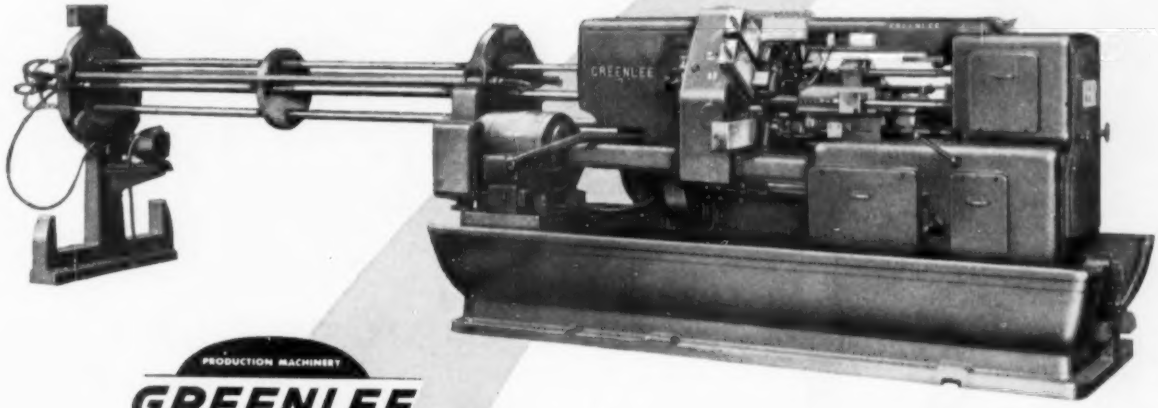
TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS



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1. **Permits Greater Job Versatility**
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3. **Provides Longer Stock Feedout**
4. **Eliminates Stock Scoring**
5. **Reduces Stock Reel Noise**
6. **Eliminates Stock Pushers**
7. **Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

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- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

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PRODUCTION MACHINERY
GREENLEE

1981 MASON AVE.
Rockford, Illinois


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Gage blanks for large diameter countersink gages.
Internal groove gage components.
Depth gage bar and pin components. 1350 model sizes available from stock.
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Davis gage components eliminate designing, detailing and building many details of special gage designs. Both design time and special gage build costs are substantially reduced.
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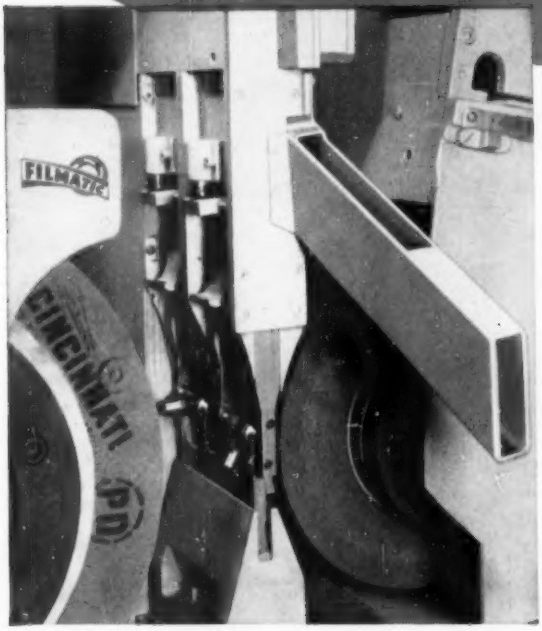
Bar type flush pin gage blanks. 46 model sizes available from stock.
Long series bar type flush pin gage blanks. 78 model sizes available from stock.
Gage component assemblies. Specified according to design needs.

Unique Transfer Idea Solved This Problem:

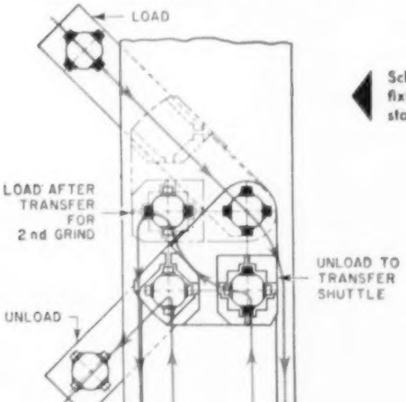
Automatically Grind Four Diameters of Universal Joint Spiders in One Cycle



Two universal joint spiders are in process at the same time, grinding two pin diameters on each of two parts. Estimated production, 300 completed parts per hour.

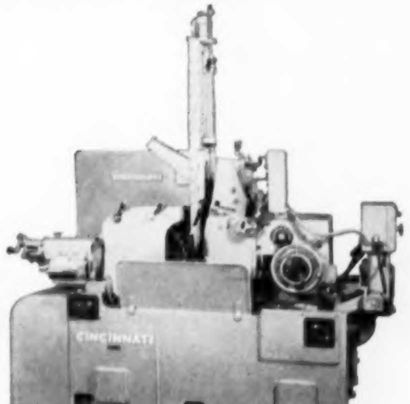
Everyone familiar with universal joint spiders will agree that it's a neat trick to automatically grind the two pin diameters on each of two parts at the same time. Cincinnati automation specialists devised a way to do the job on a new CINCINNATI® FILMATIC No. 2 Centerless Grinder. A unique transfer mechanism, incorporated in the loading fixture developed by Cincinnati for the machine, was the key to this low-cost method of production. Principle of operation is diagramed below at the left. ¶ The manufacture of universal joint spiders may not be your line of work, but some type of precision cylindrical grinding is required in your shop, and Cincinnati grinding and automation specialists can help you do a better job at lower cost. You can be sure that these men will give you the benefit of the most advanced thinking in centerless grinding methods, backed up by 33 years' experience. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Schematic drawing of loading and transfer fixture. Parts are ground on axis X in one station, and axis Y in the other.

CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped to automatically grind universal joint spiders. You will find brief information on the standard No. 2 machine in Sweet's Machine Tool File. For complete data, write for catalog No. G-644-1.



CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

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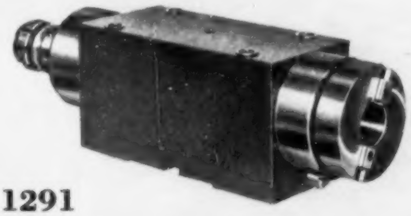
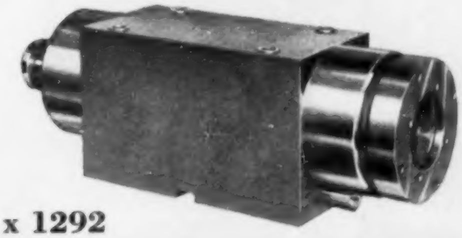
PARKER SPINDLES

FOR PRECISION BORING, MILLING AND GUN DRILLING APPLICATIONS

3 x 1290



3 x 1291



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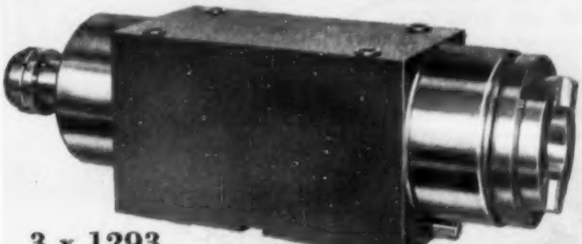

3 x 1293

Versatile—Economical

NO BETTER REASON for the success of Parker-Majestic in the design and manufacture of machine tool equipment can be found than in the acceptance of its versatile 3x1290 series of standard boring, gun drilling and milling spindles.

•

FOUR BASIC BODY SIZES, with modifications of spindle shaft and bearing design, make possible more than 75 spindles, for almost any application in which spindles are used, with speed ranges from a few RPM up to 10,000.

•

YOUR CHOICE OF SHAFTS: 1. Flange head, no shaft hole; 2. Flange head, shaft hole with rear I.D. threaded for rotary coupling; and 3. Milling machine taper head with shaft hole for draw bar.

•

MILLING MACHINE TAPERS are No. 30, 40 or 50, depending upon size of spindle.

•

DESIGN STANDARDIZATION gives you advantages of economical prices, prompt delivery.

•

WRITE TODAY for complete information, giving application, material, finish required, amount of stock to be removed. Also send part print, if possible.

PARKER-MAJESTIC pm **PRECISION MACHINES**

147 Joseph Campau • Detroit 7, Michigan

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Wherever metal needs heat

LINDBERG knows how best to apply it

If you have any part in choosing the equipment or methods of applying heat to metal it makes sense to talk it over with Lindberg. The safest way to be sure that you have the right answer for any application of heat to industry is to consult the most widely experienced experts you can find. We believe we have them here at Lindberg. Our business is concerned only with the development of industrial heating equipment and we manufacture the most complete line in the field; heat treating furnaces, melting furnaces, high-frequency induction units, ceramic kilns; big ones, small ones, electric or fuel-fired, built in our plant or field-erected.

Lindberg is a world-wide organization, and through its subsidiaries abroad has available the latest developments in heat applications in foreign industry. Over the years Lindberg research laboratories and its staff of furnace and process engineers have pioneered many of the most important developments in the industrial heating field, from the original Cyclone tempering furnace to the revolutionary new Induct-O-Ring shown and described below.

This design staff is ready to apply its experience to your requirements and recommend or create the equipment needed best to fulfill them, then thoroughly test the practicality of its recommendations through Lindberg's unique pilot plant operation. You can be sure you have the right answer when you leave it to Lindberg. So get in touch with your nearest Lindberg Field Representative (we have them in all major industrial centers) or write us direct.

Lindberg's Revolutionary New Induction Heat Treating Furnace

- For carbonitriding, bright hardening, carburizing of small parts
- No elements, no burners
- No fuel or electric connections in furnace
- Built like a fine machine tool
- Precise temperature control
- Very low maintenance
- Quiet, automatic, trouble-free

LINDBERG

induct-o-ring*

*U. S. and foreign patents pending

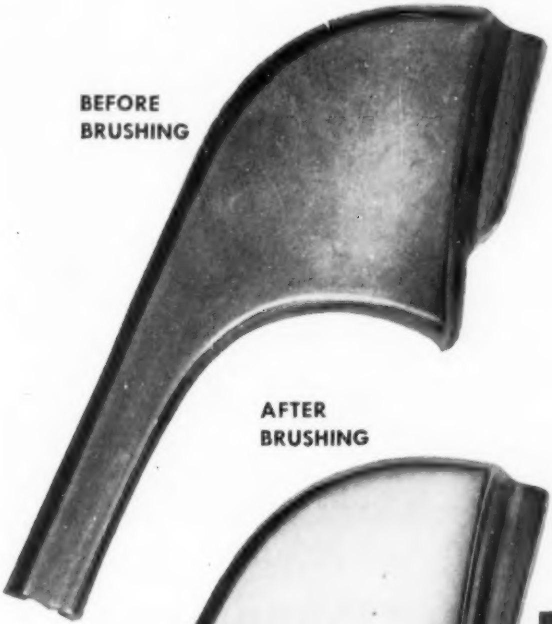
LINDBERG ENGINEERING COMPANY 2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.

OSBORN BRUSHING METHODS *worthy of your confidence*

Start of a flawless finish

BEFORE BRUSHING

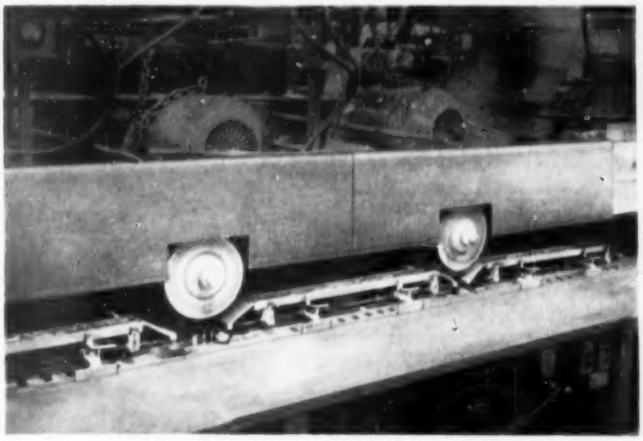


AFTER BRUSHING

THE bright finish on trim parts that "dress up" thousands of products must start with a perfect, unmarred surface prior to final buffing and plating.

Osborn power-brushing has proven the ideal production method for removing draw marks, blending imperfections as an essential preliminary step, before buffing.

These outstanding results are another reason why Osborn power brushing has gained industry's confidence. An **O**sborn **B**rushing **A**nalysis, made at no obligation, will show how *you* can benefit from this advanced finishing method. Write *The Osborn Manufacturing Company, Dept.* **K-30,** *5401 Hamilton Avenue, Cleveland 14, Ohio.*



A leading manufacturer of trim parts uses 16" diameter Osborn Fascut® Brushes, operating at 1700 rpm, to produce perfect plating surfaces

Osborn Brushes

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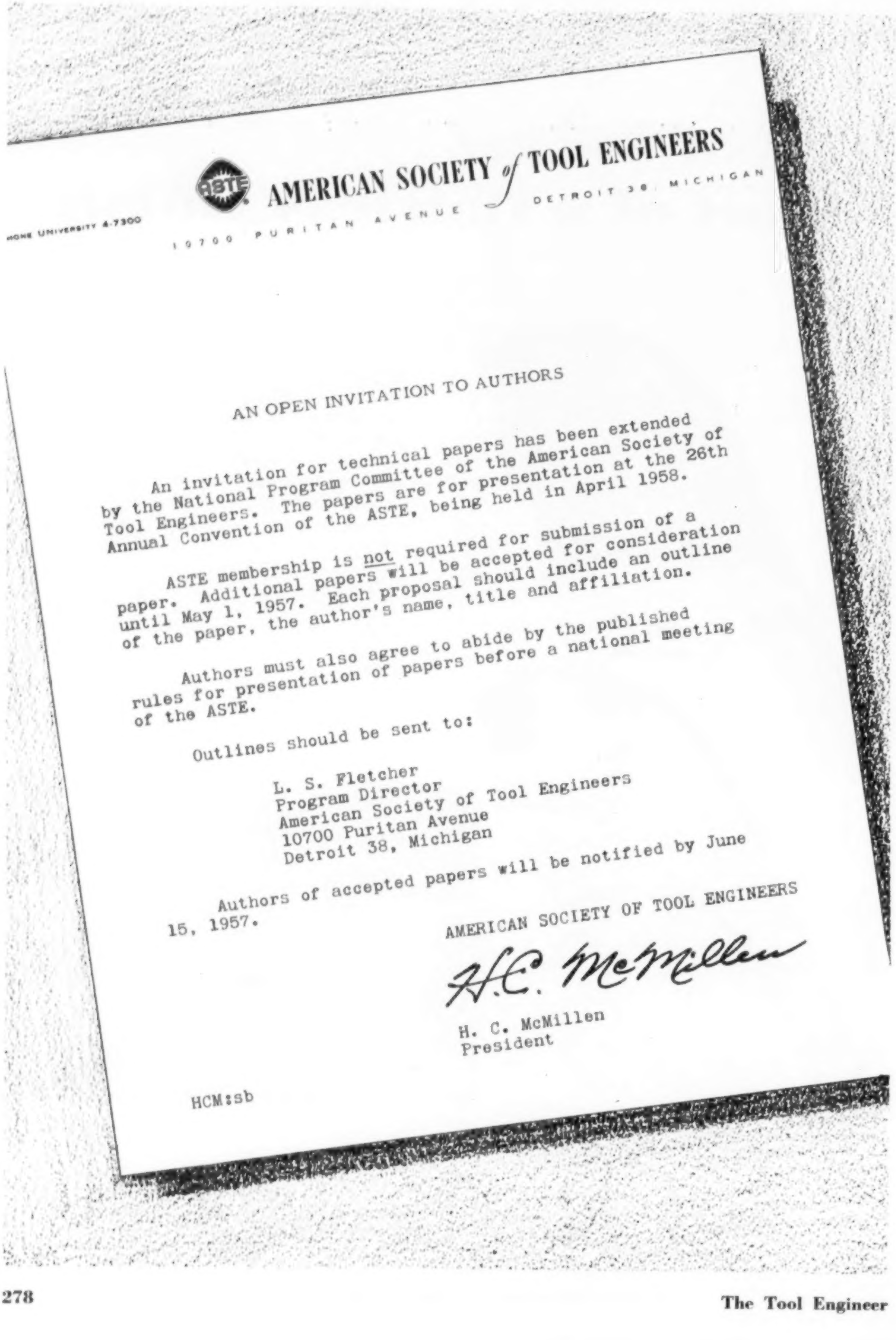


AMERICAN SOCIETY of TOOL ENGINEERS

PHONE UNIVERSITY 4-7300 — 10700 PURITAN AVENUE — DETROIT 38, MICHIGAN

AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 26th Annual Convention of the ASTE, being held in April 1958.

ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1957. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1957.

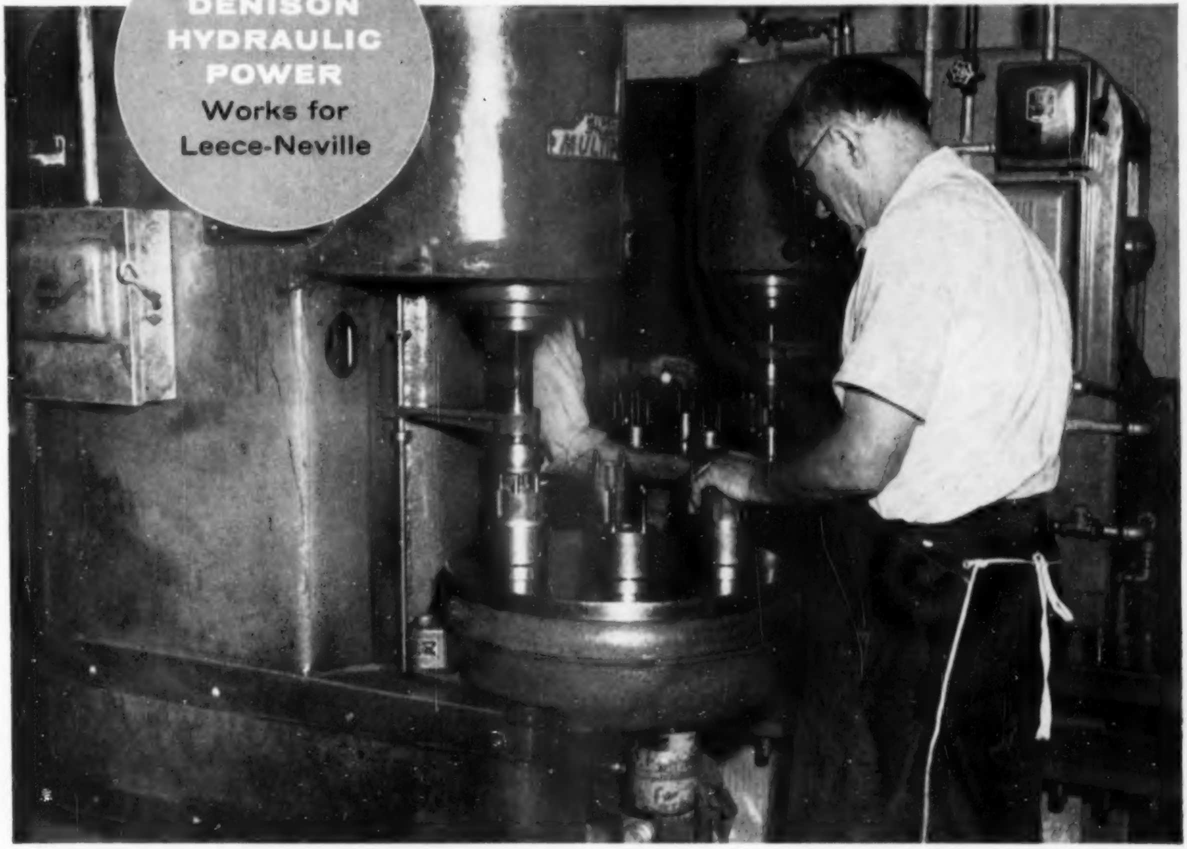
AMERICAN SOCIETY OF TOOL ENGINEERS

H. C. McMillen

H. C. McMillen
President

HCM:sb

Six-station index table on 8-ton hydraulic Multipress enables operators to stake rivets on 11,000 lamination stacks in 8-hour period.



MULTIPRESS® simplifies small motor production

4,560 brush riggings are assembled every 8 hours in this Multipress operation which eliminates bottle-necks at strategic points in the production process.

At the Leece-Neville Company, Cleveland, Ohio, fractional horsepower motors are produced around-the-clock. With the help of Denison hydraulic Multipress, automated methods have been incorporated to speed and simplify production.

An example is the use of two 8-ton presses for staking rivets on lamination stacks. In other applications, Multipress assembles brush riggings and armature cores, and notches motor housings. In all of these operations, precision control *plus* savings in time, lost motion and scrap make the investment in Multipress highly profitable.

Denison engineers are specialists at helping *your* company improve product quality. Write Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

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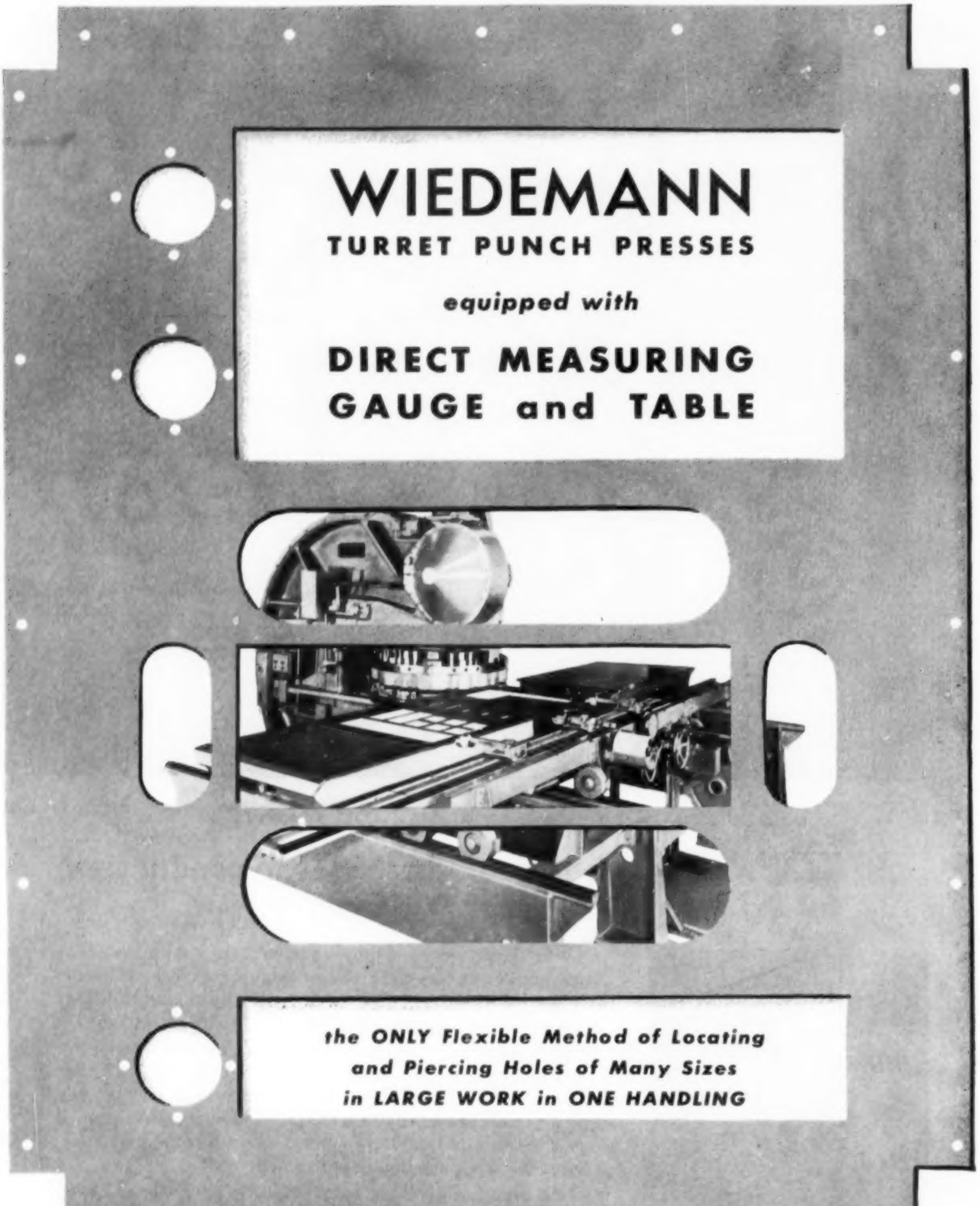
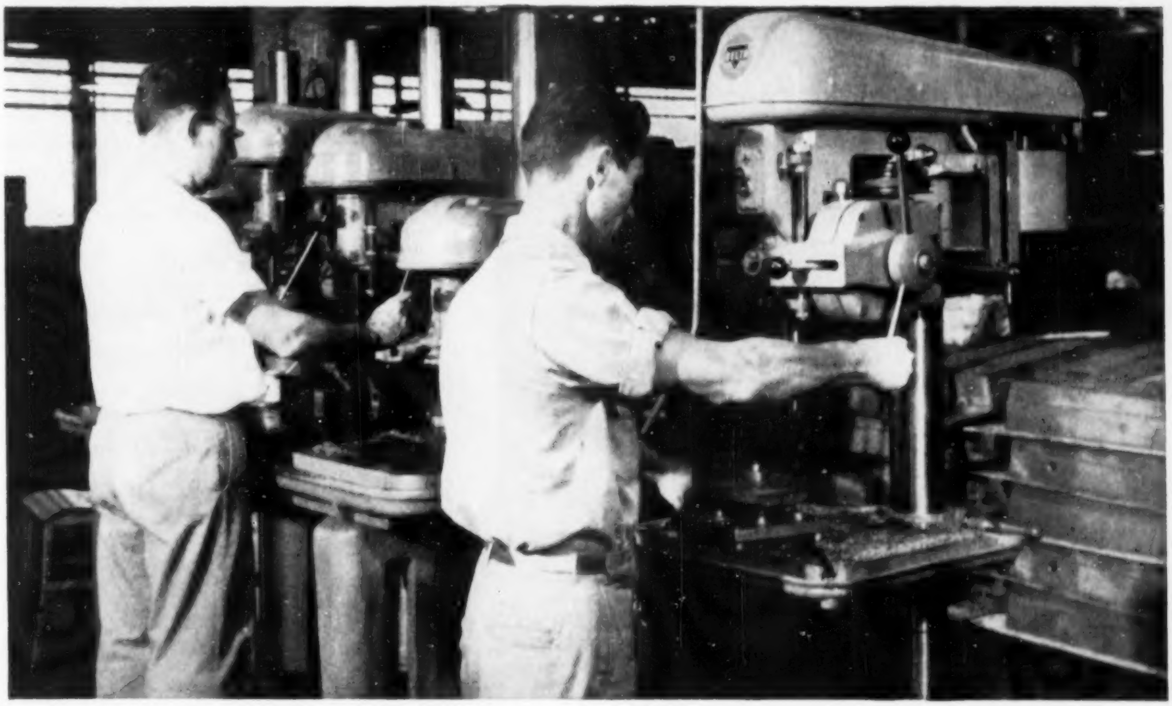

WIEDEMANN
TURRET PUNCH PRESSES
equipped with
DIRECT MEASURING
GAUGE and TABLE
the ONLY Flexible Method of Locating
and Piercing Holes of Many Sizes
in LARGE WORK in ONE HANDLING

ROCKWELL-BUILT

new DELTA 20" drill press



...fills need for low cost production tooling

Delta's great new 20" Drill Press was designed, engineered and built to fill industry's growing need for *flexible* production tooling. Here is why it can save you money by handling jobs normally requiring machines *costing four and five times as much:*

BIG MACHINE CAPACITY—You get full 6" spindle travel and long 5½' high column for *extra* spindle to table capacity, backed by massive construction and rugged power to match! It's a real production tool for jobs ordinarily demanding big, expensive special-purpose machines.

POWER TOOL VERSATILITY—New Delta 20" can be used singly for a wide range of production jobs, yet readily adapts to work in combination with special-purpose machines. And you can move it *where you need it* to reduce materials handling, save costly man hours.

LASTING PRECISION—Delta's 30 years of unmatched quality power tool experience give you precision and performance features that assure exacting tolerances (and lower maintenance) through years of hard, continuous operation.

SEE THE ENTIRE DELTA DRILL PRESS LINE: Get all the facts about the new Delta 20" plus other new and improved Delta Drill Presses. Compare for quality, for precision, for value—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

Delta Power Tool Division, Rockwell Manufacturing Co.
620A N. Lexington Ave., Pittsburgh 8, Pa.

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- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
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Company ______
Address ______
City ______ County ______ State ______

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"HARTFORD SPECIAL"

COMPLETELY TOOLED MACHINES
ready to produce on your floor

Automatic production and parts processing machinery is our business. 45 years of designing and building experience go into every machine tool that leaves our plant.

The dependable volume and consistent economy of Hartford machines is the direct result of our development and use of standard, production tested machine components.

"HARTFORD" Automatic Nine Station 45 Spindle Indexing Machine. Drills, Chamfers, Probes and Reams. Machine features automatic clamp, unclamp and part ejection.

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"All he can say is, 'What's HELLER TOOL going to announce Feb. 1?'"

USE READER SERVICE CARD; INDICATE A-1-288-2

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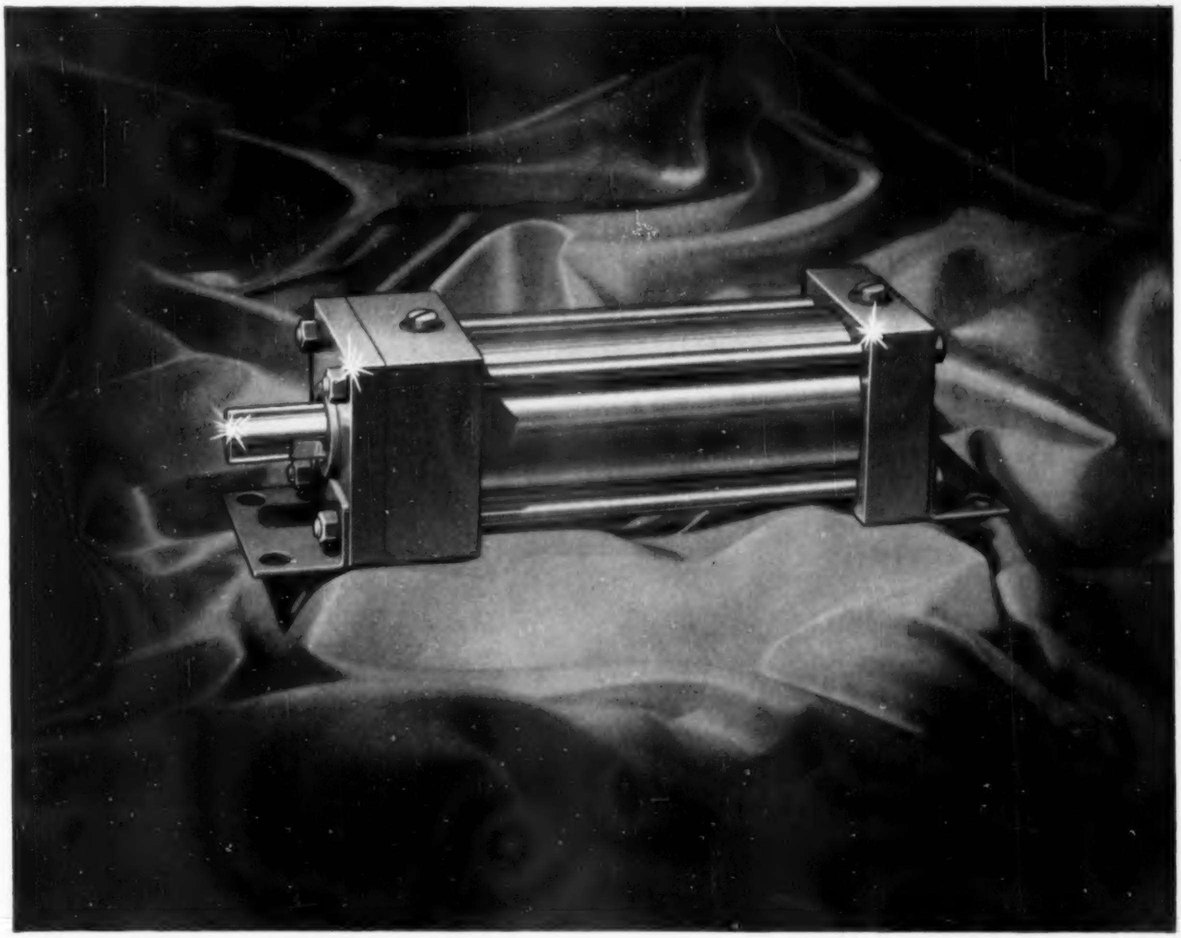
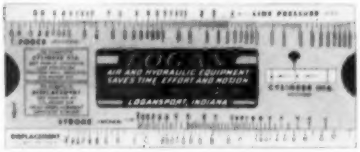


Illustrated—Logansquare Cylinder.

Look to Logan

the ultimate in air cylinder design



FREE SEND FOR THE "LOGAN CALCULATOR"
A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
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- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
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- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
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FOR AUTOMATION FEEDS...
R-J HOPPERS
RUGGEDLY BUILT FOR DURABILITY AND RELIABLE OPERATION
PROVED IN PRINCIPLE THRU YEARS OF USE
ADAPTABLE TO FEEDING MANY TYPES OF PIECES
The pieces shown are typical of those you can feed automatically with R-J Hoppers. Oriented delivery of parts can be arranged as needed. Rotation rate for the bowl is adjustable over a wide range, through changes of both sheaves and gears. Basic construction is extremely rugged, as shown, to insure durability. Bowl sizes are 16", 20", or 24". Feed plates and delivery chutes are designed for the individual pieces, and are easily interchangeable. Our experienced engineers are at your service to help solve your auto-feed problems. *To do a Real Job, use R-J Hoppers!*
WRITE FOR DETAILS
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REHNBERG-JACOBSON MFG. CO.
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MACHINE AND TOOL BUILDERS • PRODUCTION CONSULTANTS


HOLE-MAKING SOLVED FROM START TO FINISH
Boreaming
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WITH MADISON INNER DIAMETER TOOLS
You name it . . . any hole, any hole-making problem. Your Madison Man has the solution — how to machine it best at least cost. He'd like to stop at your plant and discuss your specific problems. Just drop us a note or send coupon to Dept. TE 1.
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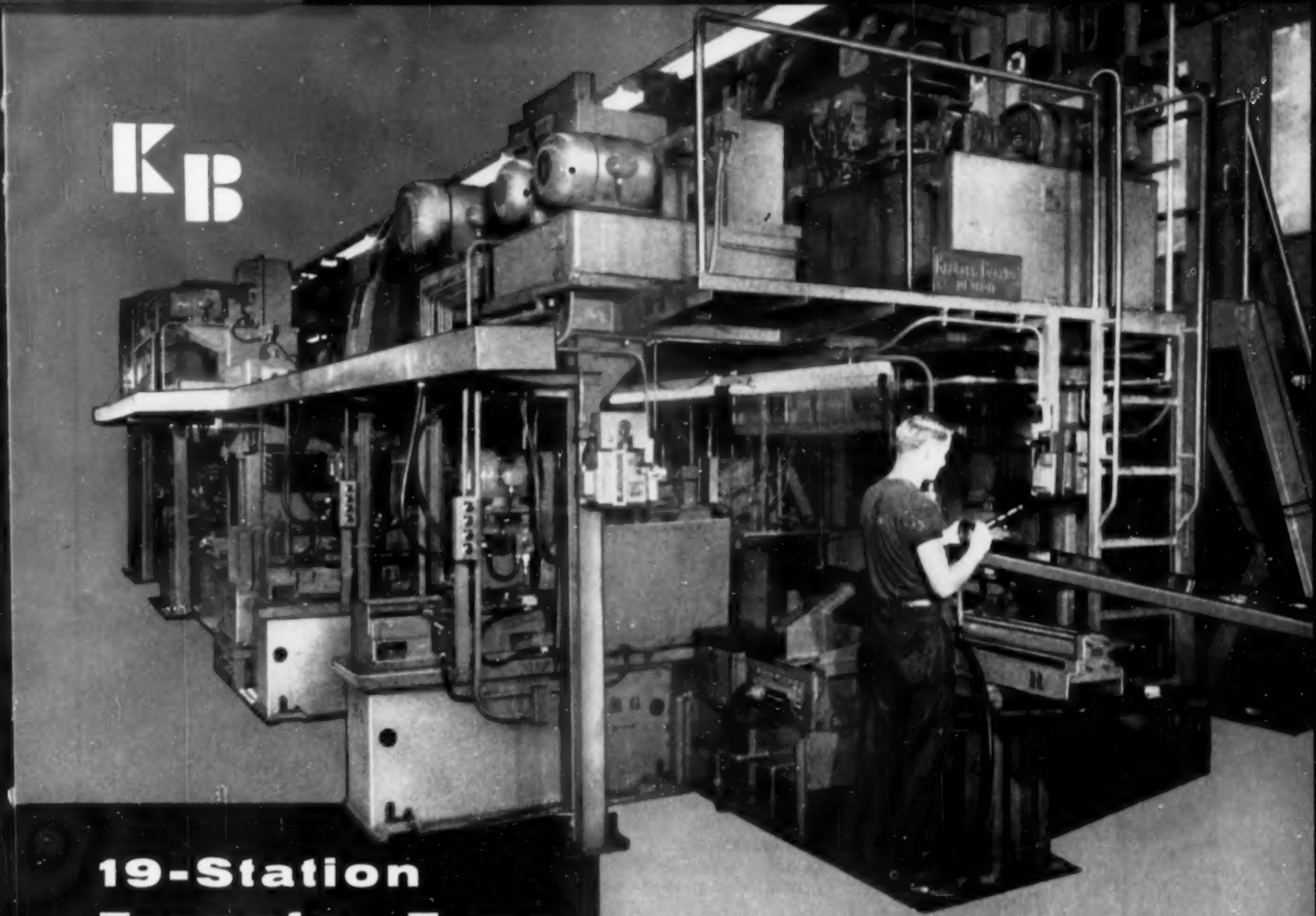
ASSOCIATED WITH MADISON-FAESSLER TOOL CO.



19-Station Transfer Type Processing Machine

Stations 2, 4, 5:	Gun drilling
6:	Probing
7, 8, 9, 10, 12, 13:	Drilling miscellaneous angular and vertical holes
14:	Combination rough reaming and deburring
16:	Generating a center in each end
17:	Gauging the centers
18:	Combination reaming two holes in line

Gun drilling — by steps at the rate of 3" per minute in intermediate shafts for automotive transmissions. Automatic transfer throughout: 6 pieces at a time for gun drilling operations, 3 at a time for the shorter operations that follow.

Production, 254 pieces per hour gross. Life of the gun drills is far in excess of expectations.

This car transmission manufacturer is believed to be the first company to use automatic transferring equipment for gun drilling by steps, where the work must be picked up and placed with extreme accuracy.

This booklet, showing Krueger-Barnes special machine applications, will be sent immediately on request.

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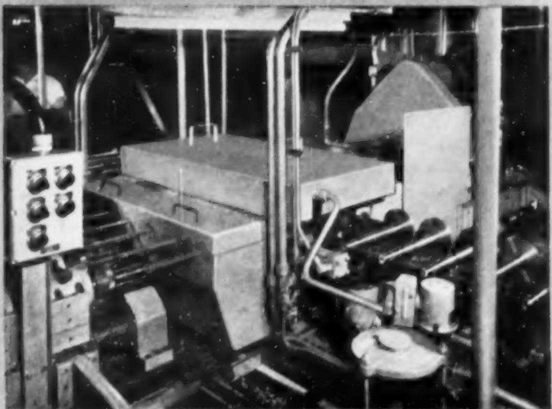
DESIGNERS AND BUILDERS OF HIGH PRODUCTION MACHINE TOOLS



Six pieces ready to be transferred into the first operating station are shown at right. Note gun drills at left. Coolant for gun drills is supplied from an underground filtering system.

Delta Air Lines Gives $225,000 Bonus in U. S. Savings Bonds

C. E. WOOLMAN
President and General Manager
DELTA AIR LINES

Delta Air Lines, Inc.

GENERAL OFFICES · ATLANTA AIRPORT · ATLANTA, GEORGIA

TO: All Members of Delta Family

FROM: President and General Manager

This has been a difficult but successful year. Each of us has had a hand in our accomplishments.

Again we want to share our good fortune with all our people and it is a pleasure to announce that all personnel with more than six months of service as of May 24, 1956, will receive a $50.00 U.S. Savings Bond. All personnel with six months of service or less as of that date will receive a $25.00 U.S. Savings Bond. The total value of these bonds will be about $225,000.00.

The bond is both a share in our achievements and an added expression of appreciation for your contribution to them.

C.E. Woolman

C.E. Woolman

If you are wondering whether *your* employees would prefer Savings Bonds to Cash . . . take a quick glance at these figures:

. . . 8,000,000 Americans enrolled in the Payroll Savings Plans of *40,000* companies invest $168 Million *per month* in U. S. Savings Bonds.

. . . 40,000,000 Americans hold $41 Billion (cash value) in Series E and Series H Savings Bonds . . . a huge reservoir of future purchasing power.

. . . 67% of *all* Series E Bonds that matured up to June, 1956—more than $21 Billion—are being held by their owners under the automatic extension program.

Join Delta Airlines—and many other fine companies—give your Bonus in Bonds—the gift that grows. Savings Bond Division, U.S. Treasury Department, Washington 25, D. C.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

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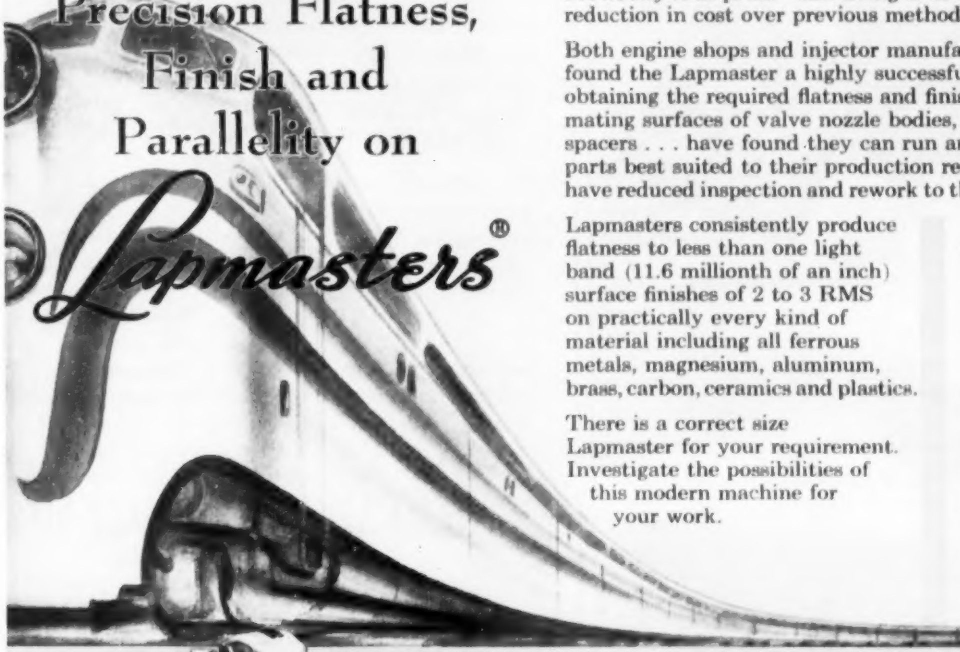
10700 Puritan Avenue Detroit 38, Michigan

Diesel Fuel Injector Parts Get Precision Flatness, Finish and Parallelity on *Lapmasters*®



. . . here's why and how

"John Crane" Lapmasters are taking over the highly critical and essential job of making diesel fuel injectors absolutely leak-proof—and doing it at a considerable reduction in cost over previous methods.

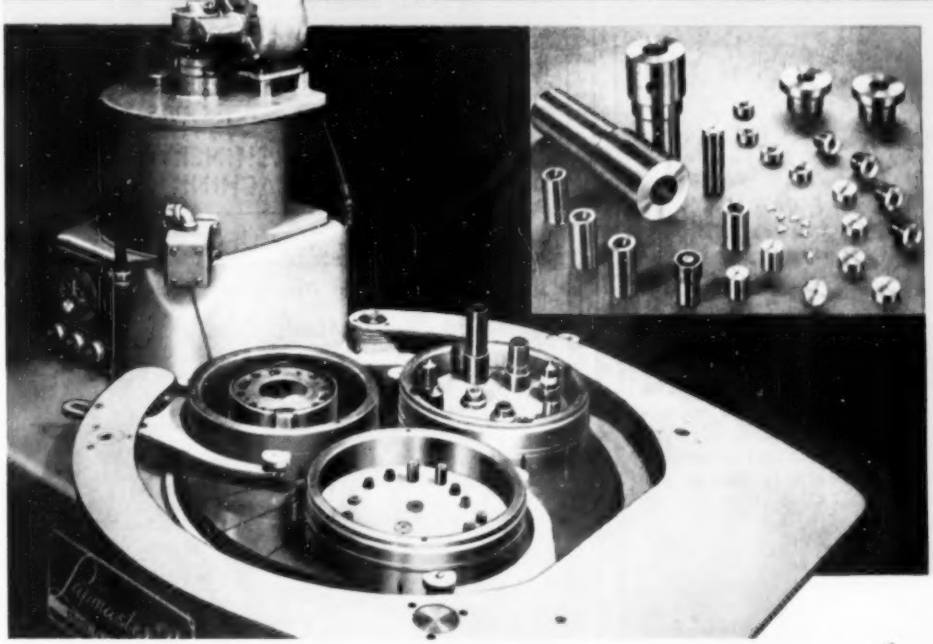
Both engine shops and injector manufacturers have found the Lapmaster a highly successful machine tool for obtaining the required flatness and finish on the mating surfaces of valve nozzle bodies, holders and spacers . . . have found they can run any combination of parts best suited to their production requirements . . . have reduced inspection and rework to the vanishing point.

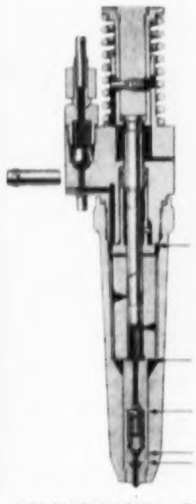
Lapmasters consistently produce flatness to less than one light band (11.6 millionth of an inch) surface finishes of 2 to 3 RMS on practically every kind of material including all ferrous metals, magnesium, aluminum, brass, carbon, ceramics and plastics.

There is a correct size Lapmaster for your requirement. Investigate the possibilities of this modern machine for your work.

FREE DATA

Send for these three booklets which describe in detail how to produce and measure precision flatness and finish.





ARROWS SHOW MATING SURFACES LAPPED

John Crane

MECHANICAL PACKINGS — SHAFT SEALS — TEFLON PRODUCTS — LAPPING MACHINES — THREAD COMPOUNDS

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ARE YOU PLANNING TO MODERNIZE YOUR TOOLING?

We invite your attention . . .

Consider these fine machine tools which hundreds of American companies, large and small, are using with such outstanding results. They represent the best Western Germany has to offer, and in most instances do not compete with American tools. Instead, our machines rather complement them.

You will notice new features, desirable capacities, and delivery of close tolerances precision built into our machines—all delivered independent of the skill of the operator. The fact that we can also offer you substantial price savings is merely coincidental.

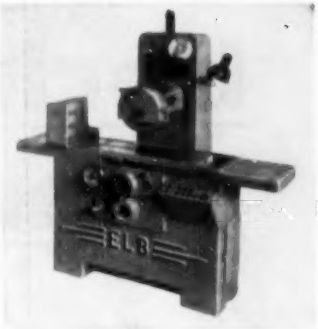
These machine tools are made to American specifications. Prices include free installation and training of your operator. The factory warranty is not six, but twelve months. Spare parts and accessories are available from stock.

Jig Boring Machines	**Milling Machines**
Radial Drilling Machines	**Planers**
Grinding Machines	**Shapers**
Optical Inspection Equipment	**Rotary Tables**
	Lathes

ELB Hydraulic Precision Surface Grinder

Sizes 12″ x 24″ to 20″ x 60″

Semi-automatic or fully automatic cycle.



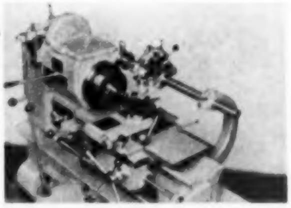
ABA Optical Layout & Measuring Machine MT 600

Table size: 16″ x 27¾″

Direct coordinate measuring to fifty millionth inch accuracy

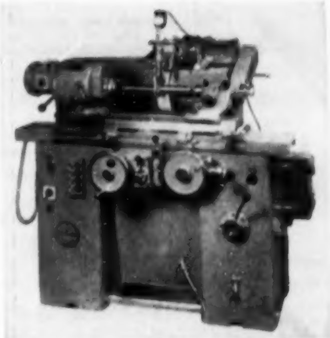
WEISSER Precision Chucking Lathe

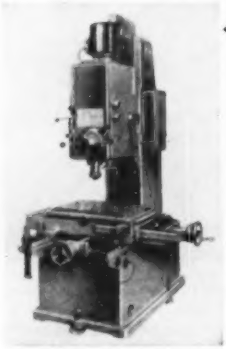
Up to 3″ bar or collet capacity
Automatic indexing
Double thread chaser
5½ H.P.
Hardened ways



KARSTEN'S High Precision Hydraulic Cylindrical Grinder, Type I.D., O.D. or Universal. Size 10″ x 15″, 10″ x 20″ or 10″ x 30″

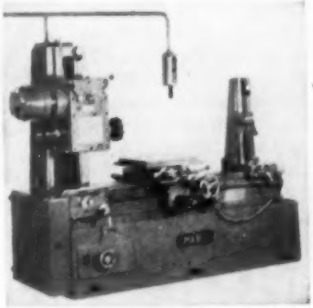
For toolroom work or fully automatic cycle.





ABA Optical Jig Borer VL 600
Table size: 16″ x 27¾″
Table travel: 17″ x 26″
Also available with electronic automatic positioning.

BURKHARDT Hydraulic Jig Borer and Jig Grinder (not illustrated)
Table size: 30½″ x 48″
Table travel: 25″ x 45″
Leitz projection optics



UMA Precision Horizontal Boring & Milling Machine (Boehringer)
2⅞″, rotary table, rapid traverse, 18″ x 22½″, inf. variable spindle speeds 50-2000, hardened ways.
VERY low price.

Catalogs of specific machines available upon request

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Now...

KENDEX*

boring bars

bring all the advantages of the Kendex principle to turret lathe boring operations

Exhaustive tests on different turret lathes** prove that Kendex Boring Bars provide all the benefits and economies of the Kendex principle now enjoyed in turning, facing, and milling operations. In addition, and probably more important in boring operations, Kendex Boring Bars provide the following advantages over other types of bars:

- **the cutting point is brought down to the center line of the bar**
- **greater support of the cutting edge is provided**
- **better chip control (uses standard Kendex chipbreaker plate)**
- **boring operations performed better at higher speeds made possible with Kendex bar**
- **permits use of thin insert—greater resistance to thermal shock**
- **throw-away insert permits use of harder grades—greater resistance to edge wear at higher speeds**
- **cutting inserts index accurately (saves time on size adjustment)—less downtime**

Kendex Boring Bars, with the right grade of "throw-away" Kennametal* insert, can be used for both rough and finish boring of pieces up to several inches in diameter. The bar with 15-degree lead angle and square insert together with the bar for turning to a square shoulder with a triangular insert will take care of practically all boring operations—thus eliminating the need for a variety of styles.

Why not call your Kennametal tool engineer to demonstrate these new Kendex bars? He will also help you select the right grade of Kennametal insert for each boring operation. Or write for additional information, KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademarks

**Tests made on Warner-Swasey, Jones & Lamson, Gisholt and other turret lathes

Kendex Boring Bars for Turret Lathes with Kennametal "throw-away" inserts . . . eliminate costly grinding . . . index accurately without re-setting tool . . . reduce machine downtime . . . slash cost per cutting edge . . . resist thermal shock . . . permit boring to close tolerances . . . better chip control (chipbreaker not shown in illustration at top of page)

C-5003

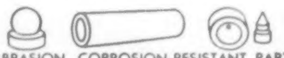
MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND

KENNAMETAL

...Partners in Progress



ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

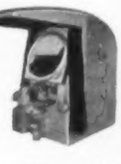
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-298

DROODLES

by ROGER PRICE

J&L

Bench Model BC-7D



Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"T-SQUARE FOR WOOZY DRAFTSMAN"

My designing uncle, Claude, invented this while working for the Biggs Chest-Wig Corp., makers of "Thorax-Thickets." The idea hit him during the annual Company Party. Unk, a fast man with a grape, was in rare form. He had just defenestrated the Accounts Receivable ledgers, and was launching into his famed take-off on Old Man Biggs, when the latter appeared. During the ensuing conversation, Claude bent his T-square over the Biggs cranium, and mankind was enriched by a new invention. Since then, C. has gone on to bigger and better things. He now owns a distillery, making "Tipple-Tot," the children's whiskey. A grand idea . . . wish I'd thought of it first!

Another thing I should have thought of first is the Optical Comparator, made by my friends, Jones & Lamson. The J&L O.C., as I familiarly call it, is a marvelously versatile instrument that is used for measuring and inspecting all sorts of parts and objects of various sizes and shapes. It is speedy and accurate (to .0001") and cuts inspection costs to the bone. The J&L Comparator is equally suited for both production-line and job-shop work, and it performs inspections that just aren't possible by any other method. Get the full details . . . send this coupon *today!*

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

A customer writes: "The J&L Optical Comparator has enabled us to reduce costly man-hours in inspection time. We are also able to accurately inspect work that previously would have been impractical. A typical case: We had a 1,840,000 piece job requiring accurately drilled .043 dia. holes ⅜" deep in 1020 steel. Drill "breakage" was excessive and hole straightness difficult until the Comparator enabled us to easily inspect all drills for precisely ground points and .0005 per inch straightness."

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

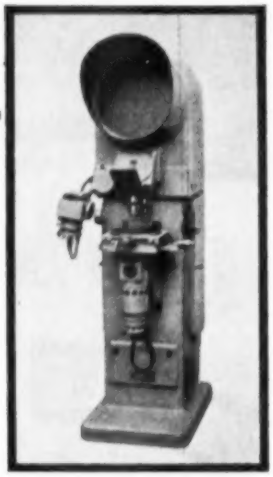
JONES & LAMSON MACHINE COMPANY, Dept. 710, 518 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name ______ title ______ street ______

company ______ city ______ zone ______ state ______

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-299



NIKON OPTICAL COMPARATOR, MODEL III

NIKON OPTICAL COMPARATORS

offer greater versatility

By means of a dual illumination system (episcopic and diascopic) the Nikon Optical Comparator permits the study and measurement of surface textures as well as edge contours. A lens turret provides rapid, convenient changeover of magnifications; lenses are available at 10, 20, 31.25, 50, 62.5, 100, 120 and 230X magnifications.

and brightest illumination

A unique condenser turret permits rapid selection of condensers to match each lens magnification for optimum illumination efficiency. This feature, in combination with the fully coated Nikkor optical system, provides an exceptionally brilliant projected image, uniformly bright from edge to edge on the viewing screen.

at lower cost

A Nikon Optical Comparator is available at considerably less cost than you would expect from an instrument that offers such accuracy and versatility.

For complete details, specifications and prices on floor and table models, write to Dept. TE-1.

NIKON INCORPORATED
251 Fourth Avenue, New York 10, N. Y.

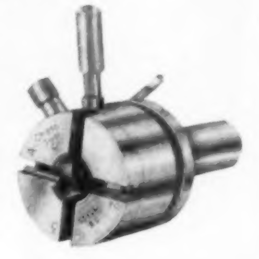
• Stereo and Research Microscopes • Optical Flats • Surveyor's Transits and other precision optical equipment

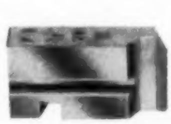
USE READER SERVICE CARD; INDICATE A-1-300-1

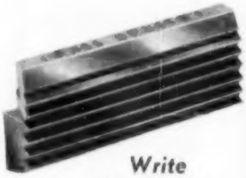
CUTTING and CHASING THREADS?

CHASO'S chasers and self opening die heads offer the fast economical way to do production threading.

CHASO manufactures all types of chasers including tangent, circular and radial in both cut thread and ground thread for most makes of die heads. Solid adjustable taps and chaser sharpening fixtures are also available.







Chaso Chasers are guaranteed to perform satisfactorily and at a savings in your threading costs.

Write For Catalog today

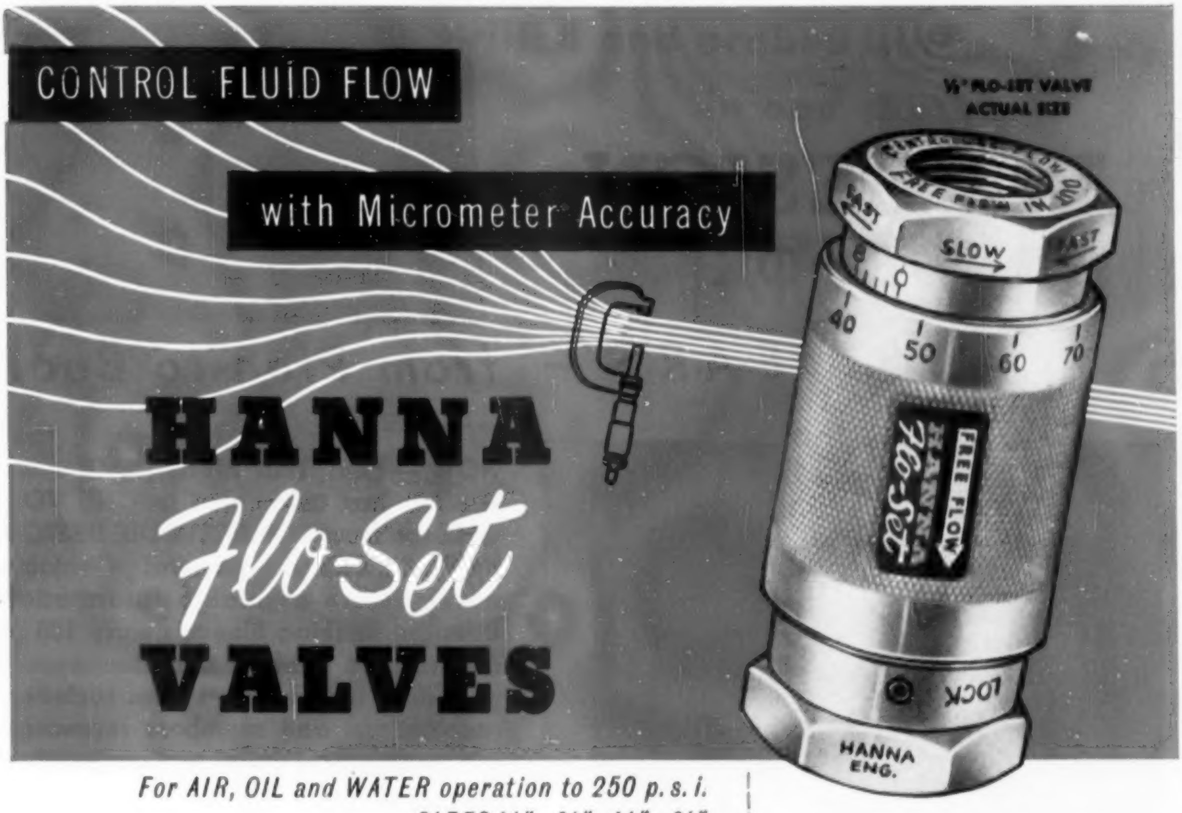
When you think of chasers think of CHASO.
MANUFACTURING CHASERS FOR 25 YEARS

CHASO TOOL CO. INC.
PHONE 2210
BOX 268A NORTH BRANCH, MICH.

ASTE DATA SHEETS

USE READER SERVICE CARD; INDICATE A-1-300-2

"My people want to know what HELLER TOOL is going to announce on Feb. 1!"



For AIR, OIL and WATER operation to 250 p.s.i.
SIZES ¼" · ⅜" · ½" · ¾"
TEMPERATURES to 250°F

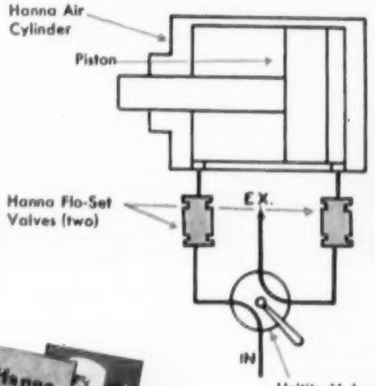
Hanna Flo-Set Valves are used to control cylinder piston speeds and operating speeds of many types of fluid actuated mechanisms. They are able to handle air, oil, water and many gases. When used with cylinders, these valves permit independent adjustments of forward and return piston speeds. The diagram at the right shows a typical circuit. Flo-Set Valves make the operation of air cylinders smoother and make cushioned cylinders more effective by building up essential back pressure.

Fluids pass unobstructed in the direction of the arrow on Hanna Flo-Set Valves. In the opposite direction, flow can be controlled from zero to full pipe capacity. One valve can be set to an infinite number of controlled flow positions. Once set, the position can be held by means of a locking collar. Established flow positions can be reset by using the micrometer graduations which accurately measure flow as a percent of full pipe capacity.

One revolution of the aluminum valve body will change the flow rate from zero to full capacity. No tools are necessary! In addition to the standard ¼", ⅜", ½" and ¾" sizes, there is a ¼" Jr. model, without micrometer graduations or locking collar, for light piping and tubing.

Typical Cylinder Circuit Using Hanna Flo-Set Speed Control Valves

Hanna engineers will gladly recommend circuits to help you with your applications.



Consult your classified telephone directory or Thomas' Register for your nearest Hanna representative. Write for Hanna Valve Catalog 254 and Flo-Set Valve Bulletin 253A.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1768 Elston Avenue • Chicago 22, Illinois

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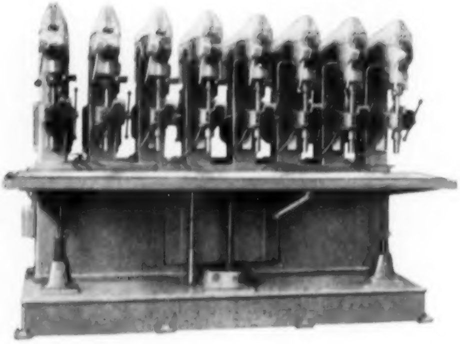
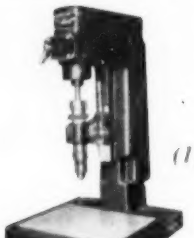
 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-305

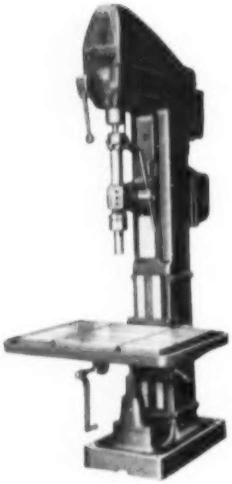


(7) Super 8 spindle

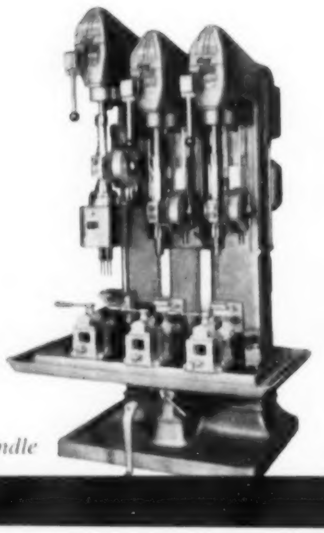
Avey has the right one



(1) Bench type

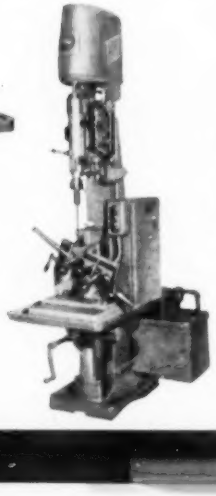


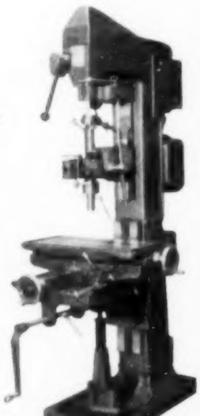
(2) Column type



(3) Multi-spindle

(4, 5, 6) Tool room drills





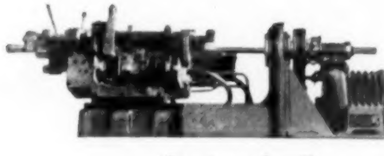
Whatever your light and medium duty drilling needs, it's a sure bet that the machine you need is made by Avey. The whole Avey line would pack this magazine with pictures —would give you every combination of size, capacity, speed, overhang, and table arrangement to fit your requirements. The ones shown will give you the general idea. Write for literature.

(Figures 1 through 6) Standard Drilling and Tapping Machines. Capacities in cast iron from very small numbered drills to 1½"; 6 or 8 speeds up to 12,000 rpm; No. 32 Jacobs chuck to No. 4 Morse taper; 4 feeds; 1 to 6 spindles; column or bench type; wide range of swing. Featuring such "bonus" advances as micrometer stop collar; telescoping spindle guard; dynamically balanced rotating parts; rack and pinion operated motor plate; large tool and die shop tables; and Avey's pace-setting spindle construction.

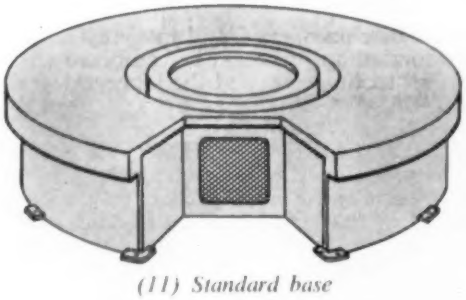
(4, 5, and 6) Avey tool room drills, built in No. 2 and No. 3 BMA-6 sizes. Large table 34" x 25"; round table 18" diameter; compound table 25" x 12".

(7) Super 8 Spindle Drilling and Tapping Machine. No. 2 Morse taper. Power lift to table by push button control. Hand feed, power feed, lead screw tapping. Four feeds, 6 speeds. Built-in coolant system.

for Avey makes them all

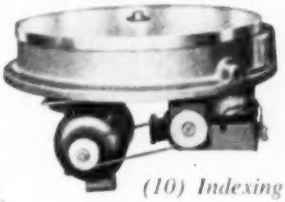


(9) Avey-draulic



(11) Standard base

(8) Cam feed unit



(10) Indexing table

(8) Automatic Cam Feed Units. For drilling, tapping, reaming, hollow milling. Vee belt or gear drive. Nos. 1, 2, and 3 Morse taper. Capacity in cast iron: No. 1, ½"; No. 2, 1". Mount at any angle. Fully or semiautomatic. Self-contained, tamper-proof.

(9) Avey-draulic feed unit. Automatic withdrawal for chip removal only when necessary during deep hole drilling. Rapid advance, feed, and rapid return. Jump feed attachment available. Standard strokes 12" up to 30". Avey's patented Torque-matic control optional.

(10) Automatic index tables. Rapid, accurate indexing to .001". Even or uneven index patterns obtainable. 16" to 48" diameter. All adaptable to Avey standard bases.

(11) Steel Bases. One of Avey's standard line of fabricated bases. Stress relieved, sandblasted, machined, and painted to fit your application. Combine 8, 9, 10, and 11, and you get fast returns on your investment, and a step ahead of your competition!

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

Automatic

FULL-UNIVERSAL MACHINES

for

DRILLING—TAPPING—THREADING

Batteries of Snow machines are found in many plants where high production output must be combined with quick set-up, low tooling cost, and the highest degree of accuracy.

A section of the second operation department of the REVERE CAMERA COMPANY is shown where the precision components for REVERE cameras and projectors are processed.

Where "quality" of product is of extreme importance, the decision is to standardize on Snow equipment.

Single Spindle Machines
Two Spindle Machines
Angular Machines
Drilling and Tapping Units
Automatic Jigs and Fixtures
Nut Tapping Machines
Horizontal Machines
Drill Press Tap Heads

SNOW

MANUFACTURING COMPANY

435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

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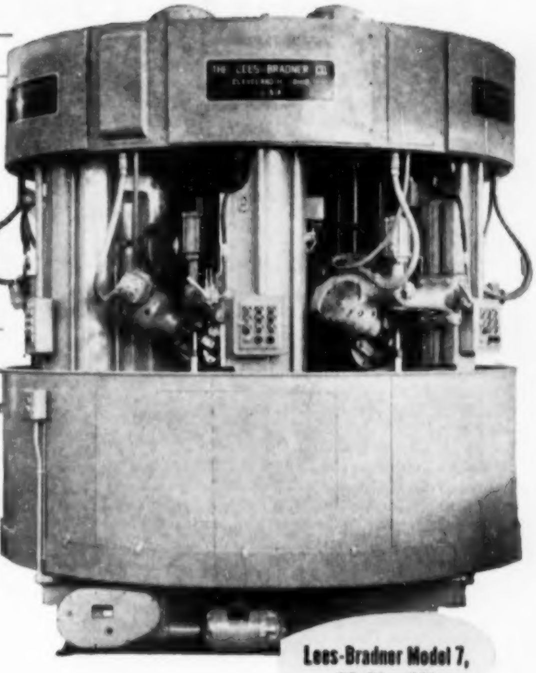
LEES-BRADNER

Sets the HOBBING pace for tomorrow

with 6 machines in 1

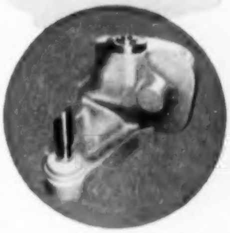


Lees-Bradner Model 7, HD 8" x 20" 6-Spindle Rotary Hobber. Also available in single and 4-spindle models.

Here's a complete hobbing production line in one space-saving unit. Actually the Lees-Bradner Model 7, HD 6-Spindle Hobber is six separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H. P. motor.

This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slowdown. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 6-spindle rotary hobber. Write or wire us direct for his name and address in your area.

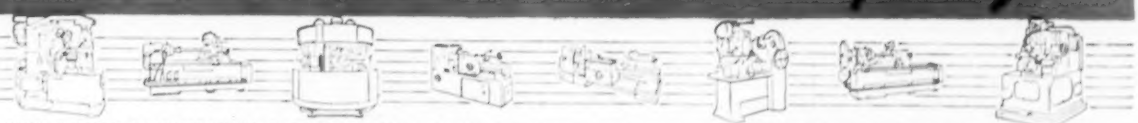


View of new HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

8-Spindle 7-A Rotary Hobbers also available.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER · HT THREAD MILLER · 7-HD ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

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Index of THE TOOL ENGINEER Advertisers

January 1957 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1956 ASTE Industrial Exposition

♦Subscriber to ASTE Data Sheet Service

You don't need to clean your spindles or draw tubes for over a year when you use...

BENCO COLLETS

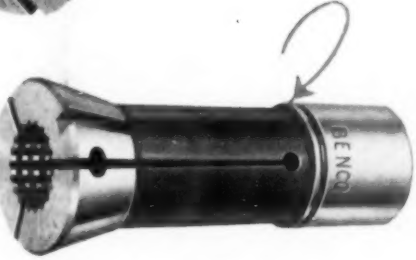
with the "O" ring seal

The above statement is true! We've proved it in our own plant, where the conditions and machines are much the same as in any shop today. The simple little "O" ring seal in the Benco Collet is the most efficient method ever discovered for preventing dirt and chips from getting between the draw tube and spindle wall, and into the actuating mechanism at the end of the spindle. It's a money saver and time saver every day and the collets with the "O" ring seal cost you no more than ordinary collets.

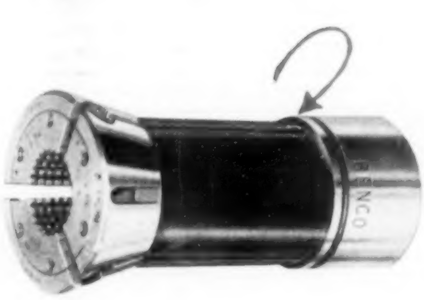
This is only one outstanding feature of the Benco line of Solid and Master Collets. Benco precision collet manufacturing methods applied to selected alloy steel, followed by careful heat treating and rigid inspection guarantee better production from your machines.

Benco Collets are stocked in a large range of sizes for all popular makes of automatics. Select them every time...you just can't get better quality, performance or value!

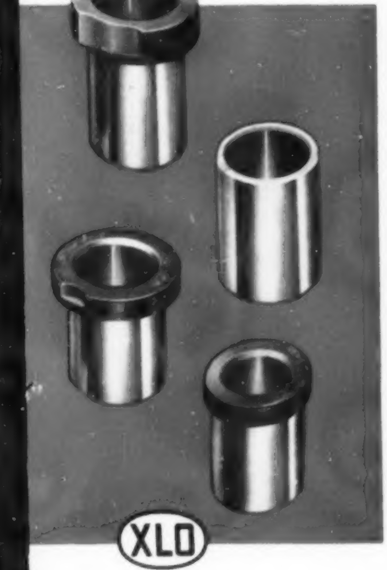
Write for new catalog.



BENCO COLLET MANUFACTURING CO.
Cleveland 14, Ohio



Up to twice as much production per .001" of wear!



TEST REPORT SHOWS THERE IS A DIFFERENCE IN BUSHINGS

Ex-Cell-O Bushings out-perform competition.

An automotive manufacturer proved this conclusively by putting Ex-Cell-O Bushings up against two other leading brands in a practical, on-the-job test. Result: Ex-Cell-O out-produced brand A by 1210 pieces, brand B by 345 pieces! Average number of parts produced during .001" wear:

Brand A	1,045 pieces
Brand B	1,910 pieces
Ex-Cell-O	2,255 pieces

An important reason for this outstanding performance is that Ex-Cell-O uses high chrome and high carbon oil-hardening steel, heat treated in Ex-Cell-O's automatic atmosphere-controlled equipment to uniform 62-64 Rockwell "C." These bushings are precision ground inside and out and under the head for perfect seating. Try Ex-Cell-O Bushings and see for yourself.

For "same day" shipment write or wire Ex-Cell-O in Detroit or call your Ex-Cell-O Representative. Catalog available on request.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

XLO
EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-57